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STARTAP LOYIHALARINING MOLIYAVIY TUZILISHI, MANBALARI, KAPITALNI JALB QILISHDA INVESTORLARNING ROLI HAMDA MOLIYAVIY BOSHQARUVI

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Annotatsiya: Xususiy moliyalashtirish iqtisodiyotning rivojlanishiga xizmat qiluvchi asosiy mexanizmlardan biri bo‘lib, korxonalar va loyihalarning barqarorligini ta’minlashda muhim ahamiyat kasb etadi hamda uning zamonaviy shakllari, xususan, venchur kapital va Kraudfanding, innovatsion g‘oyalarni amaliyotga joriy etishda sezilarli hissa qo‘shadi.
Kalit so‘zlar: Moliyalashtirish, startaplar, moliyalashtirishning shakllari, mentorlar loyihasi, ijtimoiy manfaatdorlik, trening, biznes, startaplar, tanlov, moliyaviy resurslar, infratuzilmani rivojlantirish, ta’lim, sog‘liqni saqlash, texnologik yangiliklar, loyiha taqdimoti, yoshlar uchun yangi imkoniyatlar, rivojlanish, g‘oliblar, grantlar, moliyalashtirish manbalari.

Startaplarning moliyaviy tuzilishi ularning muvaffaqiyatli faoliyat yuritishi uchun juda muhimdir. Ular boshlang‘ich bosqichda o‘z faoliyatini davom ettirish va rivojlantirish uchun turli moliyaviy manbalar va kapitalni jalb qilish strategiyalariga muhtoj. Shu bilan birga, startaplar uchun kapitalni jalb qilishda investorlarning roli bevosita katta ahamiyatga ega, chunki ular kompaniyaning o‘sishiga yordam berishlari, yangi texnologiyalarni joriy etishlari va bozorda raqobatbardoshligini oshirishlari mumkin.
Moliyalashtirishning asosiy shakllari - Moliyalashtirishning shakllari u amalga oshirilayotgan manbalar, vositalar va shartlarga qarab farqlanadi.
Davlat moliyalashtirish - Bu iqtisodiy va ijtimoiy rivojlanishni ta’minlash maqsadida davlat byudjeti, maxsus fondlar yoki davlat tashkilotlari orqali mablag‘ ajratish jarayonidir. Bu shakl odatda ijtimoiy ahamiyatga ega bo‘lgan loyihalarni, infratuzilmani rivojlantirish, ta’lim, sog‘liqni saqlash va texnologik yangiliklarni qo‘llab-quvvatlashda qo‘llaniladi. Davlat moliyalashtirish davlat tomonidan taqdim etiladigan grantlar, subsidiyalar va imtiyozli kreditlar orqali amalga oshiriladi.
Xususiyatlari:
- Odatda ijtimoiy va iqtisodiy ahamiyatga ega loyihalarni qo‘llab-quvvatlash uchun ajratiladi.
- Qaytarib berish shartlari yo‘q yoki imtiyozli sharoitlarda amalga oshiriladi.

Davlat tomonidan moliyalashtirishning afzalliklari:

– Ijtimoiy manfaatdorlik: Davlat moliyalashtirishi orqali ko‘plab ijtimoiy ahamiyatga ega loyihalar amalga oshiriladi.
– Barqarorlik: Davlat tomonidan kafolatlangan mablag‘ manbai loyihalarni barqaror amalga oshirishni ta’minlaydi.
– Xavfsizlik: Mablag‘lar davlat nazorati ostida bo‘lgani sababli moliyaviy xavflar minimal darajada bo‘ladi.

Davlat tomonidan moliyalashtirishning kamchiliklari:

– Byudjet cheklovlari: Davlat byudjeti mablag‘lari yetarli bo‘lmagan hollarda moliyalashtirish chegaralanadi.
– Byurokratik to‘siqlar: Mablag‘larni olish jarayonida ko‘plab hujjat va rasmiyatchilik talab etiladi.
– Qaramlikka olib kelishi: Doimiy davlat yordamiga tayanish xususiy sektor mustaqilligini pasaytirishi mumkin.

Misol: Innovatsion rivojlanish agentligi tomonidan tashkil etiladigan tanlovlarga asosan ilmiy faoliyatga oid davlat dasturi doirasida ajratiladigan mablag‘lar hisobidan moliyalashtiriladigan startap loyihalar.

Xususiy moliyalashtirish – bu korxona, loyiha yoki tashabbusni amalga oshirish uchun o‘z yoki xususiy sektorning boshqa subyektlari tomonidan mablag‘ ajratish jarayonidir. Bu shakl xususiy investorlar, kompaniyalar va boshqa tijorat tashkilotlari tomonidan taqdim etiladi. Xususiy moliyalashtirish odatda tijorat maqsadlarini, ya’ni foyda olishni ko‘zlaydi va investorlarning loyihadagi ishtiroki, rentabellik darajasi va xatarlar bilan bog‘liq. Xususiy moliyalashtirish xususiy kompaniyalar, investorlar yoki fondlar tomonidan amalga oshiriladi.

Xususiyatlari:

– Investorlar foyda olish maqsadida mablag‘ kiritadi.
– Qaytarish shartlari va rentabellik darajasi muhim omil hisoblanadi.

Xususiy moliyalashtirishning afzalliklari:

– Tezkorlik: Moliyalashtirish jarayoni odatda davlat moliyalashtirishiga qaraganda tezroq amalga oshiriladi.
– Moslashuvchanlik: Xususiy moliyalashtirish shartlari ikki tomonning kelishuviga ko‘ra moslashtirilishi mumkin.
– Xatarlarni taqsimlash: Investorlarning startapda ishtiroki xatarlarni taqsimlash imkoniyatini beradi.
– Qo‘shimcha xizmatlar: Investorlar moliyaviy ko‘mak bilan birga biznes maslahatlarini ham taklif etadi.

Xususiy moliyalashtirishning kamchiliklari:

– Moliyaviy bosim: Investorlar o‘z ulushidan maksimal foyda olishni kutadi, bu esa loyiha uchun moliyaviy yuk bo‘lishi mumkin.
– Nazoratni yo‘qotish xavfi: Investorlarning loyihada nazorat qilish huquqi ortishi mumkin.
– Qimmat moliyalashtirish: Xususiy kapital davlat mablag‘lariga qaraganda yuqori foiz stavkalari yoki katta daromad ulushini talab qiladi.

Misol: Artel kompaniyasi o‘z tarkibidagi Tadqiqotlar va innovatsiyalar markazi faoliyatini doimiy moliyalashtirib turishi.

Startup Garage platformasi.

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BIOLOGICAL SIGNIFICANCE OF SOME MICROELEMENTS IN WOMEN OF REPRODUCTIVE AGE WITH CHRONIC VIRAL HEPATITIS B LIVING IN THE ARAL SEA REGION

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The aim of the study was to investigate the influence of certain microelements (zinc, selenium) on the clinical course of chronic viral hepatitis B (CVHB) in women of reproductive age living in the city of Urgench.

Materials and methods of research. A prospective case-control study was conducted with 52 women of reproductive age diagnosed with CVHB,undergoing treatment at the Urgench District Infectious Diseases Hospital, and a control group of 10 apparently healthy women of reproductive age living in the Urgench district of Khorezm region. The levels of selenium and zinc microelements in the blood serum of patients were analyzed in the clinical laboratory of RIIEMYUPKIATM using the "endpoint" method with a biochemical analyzer.

Results obtained. The mean serum selenium level in the main group was 48.7±0.98 μg/dL, which was 1.0 times lower than the value in healthy women (51.3±0.23 μg/dL) (p=0.012297). The content of zinc in the blood serum of patients was 3704.3±74.3 μg/L and was 1.1 times lower than the value in healthy women (5048.7±110.1 μg/L) (p=0.001987). When studying the microelement levels depending on the activity of the chronic infectious process in patients of the main group, it was found that in 5 patients with minimal activity of the chronic infectious process, the level averaged 52.2±1.1 μg/dL, in patients with moderate activity - 47.7±0.87 μg/dL, and in those with high activity - 44.3±0.73 μg/dL. When studying the correlation between selenium levels and activity of the chronic infectious process, astrong positive correlation was revealed (r=1.0), which means that as the serum selenium level decreased, the chronic process intensified. Similar changes were also found in relation to zinc levels. In patients with high activity, the zinc level was on average 3054.8±54.3 μg/L, in women with moderate activity - 3827.6±71.2 μg/L, and in those with minimal activity - 3140.2±68.7 μg/L. Selenium and zinc levels in the blood serum of apparently healthy women of reproductive age living in the city of Urgench, which is considered an environmentally unfavorable area, were significantly lower than the reference level. In women with chronic viral hepatitis B, the levels of these microelements decreased even further, which led to the activation of the chronic infectious process.

Conclusions. Selenium and zinc levels in the blood serum of apparently healthy women of reproductive age in the ecologically unfavorable area of Urgench arebelow normal, and in women with CVHB, a deficiency of selenium and zinc in blood serum is observed. There is a strong, positive correlation between the decrease in selenium and zinc levels and the activity of the chronic infectious process.

O’ZBEKISTONDA YASHIL IQTISODIYOTGA O`TISHDA TURIZMNI AHAMIYATI VA O’RNI

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Annotatsiya: Ushbu maqolada O'zbekistonda yashil iqtisodiyotga o'tish jarayonida turizm sohasining tutgan o'rni tahlil qilinadi. Yashil turizm (ekoturizm) konsepsiyasining mohiyati, barqaror rivojlanish tamoyillari bilan uyg'unligi va ekologik toza iqtisodiy faoliyat sifatidagi afzalliklari ko‘rib chiqiladi. Shu bilan birga, O'zbekistonda mavjud tabiiy va madaniy meros obyektlaridan samarali foydalanish, ularni asrash hamda ekologik xavfsizlikni ta'minlash orqali iqtisodiy o'sishga erishish imkoniyatlari yoritiladi.

Kalit so‘zlar: Yashil iqtisodiyot, turizm, ekoturizm, barqaror rivojlanish, ekologik xavfsizlik, tabiiy resurslar, iqtisodiy o‘sish.

Bugungi kunda global miqyosda ekologik muammolar chuqurlashib borar ekan, ko‘plab davlatlar iqtisodiy rivojlanishni atrof-muhitga zarar yetkazmasdan amalga oshirish yo‘llarini izlamoqda. Bunday yondashuv “yashil iqtisodiyot” deb nomlanadi. O‘zbekiston ham ushbu konsepsiyani milliy strategiyalariga tatbiq etmoqda. Shu nuqtai nazardan, turizm sohasi yashil iqtisodiyotning muhim tarkibiy qismi sifatida alohida e’tiborni talab etadi.

Yashil iqtisodiyot — bu iqtisodiy faoliyat turlari orasida ekologik barqarorlik, tabiiy resurslardan oqilona foydalanish va chiqindilarni kamaytirish kabi mezonlarga asoslangan yondashuvdir. Turizm sohasi esa bevosita tabiiy va madaniy resurslarga tayangan holda rivojlanadi. Ayniqsa, ekoturizm, agroturizm va madaniy-tarixiy turizm turlari nafaqat iqtisodiy foyda keltiradi, balki muhitni asrash va mahalliy aholining farovonligini oshirishga xizmat qiladi.

O‘zbekiston boy tabiiy resurslari, noyob landshaftlari, milliy bog‘lar va tarixiy yodgorliklarga ega mamlakat sifatida yashil turizmni rivojlantirish uchun katta salohiyatga ega. Misol uchun, Zarafshon, Nurata, Hisor tog‘ tizmalari, Aydar-Arnasoy ko‘llar tizimi hamda Surxondaryo viloyatidagi bioxilma-xillik zonalari ekoturizm uchun noyob imkoniyatlar yaratadi.

O‘zbekistonda turizm sohasini jadal sur’atlarda rivojlanadigan drayverиtarmog‘iga aylantirish, sohani sifat jihatdan rivojlantirishning yangi bosqichiga olib chiqish, turistik
salohiyatdan samarali foydalanish, turistik xizmatlar tarkibini takomillashtirish kabi yo‘nalishlarda islohotlar olib borilmoqda. Mamlakatimizda “....xorijiy turistlar sonini 15 millionga yetkazish, ichki sayyohlar sonini 25 millionga, ziyorat turizmi bo‘yicha keladigan turistlar sonini 3 million nafarga oshirish” kabi vazifalar belgilangan.

Shuningdek, global miqyosda ekologik muammolarning keskinlashuvi va tabiiy resurslarning chegaralanganligi «yashil» iqtisodiyot kontseptsiyasini iqtisodiy rivojlanishning dolzarb yo‘nalishiga aylantirdi. Har bir davlat endi faqat iqtisodiy o‘sishga emas, balki barqarorlik, ijtimoiy farovonlik va ekologik muvozanatni saqlashga ham e'tibor qaratmoqda. Ayniqsa, tabiatga bog‘liq sektorlar – turizm va xizmatlar sohasi – tabiiy muhit holatidan bevosita ta'sirlanadi. Shu nuqtai nazardan, «yashil» iqtisodiyotga o‘tish jarayonida turizm va xizmatlar sohasini rivojlantirish istiqbollari alohida tadqiqot obyekti sanaladi.

Yashil turizm modeliga o‘tish bir necha yo‘nalishda rivojlanmoqda:

1.Ekoturizm.Bu mahalliy bioxilma-xillikka asoslangan marshrutlar, milliy bog‘lar, biologik turfa muhitlarni himoya qiluvchi sayohatlar tashkil etadi.Bu yo‘nalish tabiatni muhofaza etish va mahalliy iqtisodiyotni qo‘llab-quvvatlash imkonini beradi.

2.Barqaror mehmonxona infratuzilmasi. Bunda zamonaviy mehmonxonalar ekologik sertifikatga (LEED, Green Key va boshqalar) ega bo‘lib, yashil turizmga joziba yaratadi.

3.Mahalliy hamjamiyat bilan hamkorlik.Bunda asosan turoperatorlar mahalliy aholining milliy an’analariga hurmat ko‘rsatish, hunarmandchilik mahsulotlari va mahalliy oziq-ovqat mahsulotlarini tur paketlariga kiritish orqali ijtimoiy barqarorlik va iqtisodiy daromadni ta’minlaydi.

4.Yashil transport. Bunda elektr avtobuslar, gidrovelo yo‘nalishlari, piyoda yurish va velosayohat marshrutlarini rivojlantirish tabiatga zarar yetkazmasdan sayyohlarni manzillarga yetkazishga yordam beradi

Bundan tashqari, qadimiy shaharlardagi madaniy meros obyektlari (Samarqand, Buxoro, Xiva) barqaror turizm orqali saqlanib qolishi mumkin.

O‘zbekistonda turizm sohasini jadal sur’atlarda rivojlanadigan drayverиtarmog‘iga aylantirish, sohani sifat jihatdan rivojlantirishning yangi bosqichiga olib chiqish, turistik salohiyatdan samarali foydalanish, turistik xizmatlar tarkibini takomillashtirish kabi yo‘nalishlarda islohotlar olib borilmoqda. Mamlakatimizda “....xorijiy turistlar sonini 15 millionga yetkazish, ichki sayyohlar sonini 25 millionga, ziyorat turizmi

bo‘yicha keladigan turistlar sonini 3 million nafarga oshirish” kabi vazifalar belgilangan.

Yashil turizm O‘zbekistonda yangi ish o‘rinlari yaratish, mahalliy ishlab chiqaruvchilarni qo‘llab-quvvatlash va qishloq joylarda yashash sifatini yaxshilashga xizmat qiladi. Mahalliy aholining turizmda ishtirok etishi, ekologik ongning oshishi, o‘z merosiga nisbatan e’tibor ortishiga sabab bo‘ladi. Bu esa ijtimoiy barqarorlikni ta’minlashda muhim omildir.

Yashil turizmni rivojlantirishda bir qator muammolar mavjud:

- Ekoturizm infrastrukturasi yetarli emas
- Mahalliy aholi bilim va ko‘nikmalariga ehtiyoj katta
- Qonunchilikda ekologik turizmni qo‘llab-quvvatlovchi mexanizmlar kuchsiz

Shu sababli quyidagi tavsiyalar muhim:

Yashil turizm modeliga o‘tish bir necha yo‘nalishda rivojlanmoqda:

1.Ekoturizm.Bu mahalliy bioxilma-xillikka asoslangan marshrutlar, milliy bog‘lar, biologik turfa muhitlarni himoya qiluvchi sayohatlar tashkil etadi.Bu yo‘nalish tabiatni muhofaza etish va mahalliy iqtisodiyotni qo‘llab-quvvatlash imkonini beradi.

2.Barqaror mehmonxona infratuzilmasi. Bunda zamonaviy mehmonxonalar ekologik sertifikatga (LEED, Green Key va boshqalar) ega bo‘lib, yashil turizmga joziba yaratadi.

3.Mahalliy hamjamiyat bilan hamkorlik.Bunda asosan turoperatorlar mahalliy aholining milliy an’analariga hurmat ko‘rsatish, hunarmandchilik mahsulotlari va mahalliy oziq-ovqat mahsulotlarini tur paketlariga kiritish orqali ijtimoiy barqarorlik va iqtisodiy daromadni ta’minlaydi.

4.Yashil transport. Bunda elektr avtobuslar, gidrovelo yo‘nalishlari, piyoda yurish va velosayohat marshrutlarini rivojlantirish tabiatga zarar yetkazmasdan sayyohlarni manzillarga yetkazishga yordam beradi [2].

Shu bilan birga ,yashil iqtisodiyotga o`tishda turizmning kelajak istibollariga to`xtalib o`tamiz.

Xulosa qilib aytganda, O‘zbekiston yashil iqtisodiyotga o‘tish yo‘lida turizm sohasining imkoniyatlaridan to‘liq foydalanishi zarur. Ekologik jihatdan xavfsiz va barqaror turizm nafaqat iqtisodiy o‘sishni ta’minlaydi, balki atrof-muhitni asrash va jamiyat farovonligini oshirishda muhim vosita bo‘lib xizmat qiladi.

Respublikamizda yashil iqtisodiyotga o‘tishda muhim katalizator vazifasini o‘taydi. Xorijiy tajribalar shuni ko‘rsatadiki, ekoturizm sertifikatlari, mahalliy jamoalarning ishtiroki, raqamli yechimlar va yashil infratuzilma birlashtirilganda iqtisodiy o‘sish bilan birga atrof-muhitni muhofaza qilishga ham erishish mumkin.

Kelajakda raqamli texnologiyalar, mahalliy hamkorlik va xalqaro moliyaviy instrumentlar yordamidamintaqamiz “yashil turizm markazi”ga aylanish salohiyatiga ega. Shu yo‘nalishda to‘g‘ri siyosat, hamkorlik va innovatsiyalarni joriy etish bizni barqaror rivojlanishga olib boradi.

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ROLE OF PEDAGOGICAL TECHNOLOGIES IN EDUCATION IN UZBEKISTAN

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Abstract. This article briefly discusses the methods of forming the interest of schoolchildren in technology during extracurricular activities.
Key words: personnel, science and technology, information and innovative technologies, pedagogical technologies, teaching methods, interactive method.

Today, the reforms carried out in our country are aimed at perfecting the personnel training system, development on the basis of modern science and technology, culture and technology. The state policy in the field of personnel training envisages the formation of a comprehensively developed person - a citizen through the continuous education system. This, in turn, raises the issue of education, training, and development of a person on the basis of science and technology, information and innovative technologies.

Strong organizational and legal mechanisms are gradually being created in our country for the fundamental improvement of the upbringing and education system, and the development of the worthy successors of our tomorrow.

In recent years, according to a number of state programs related to the field, many educational institutions have been rebuilt, equipped with the most modern educational equipment, and modern educational programs and teaching methods have been studied and taught in the world. a new approach to the education process, innovative technologies are being applied. In order to effectively implement these new methods, all school teachers are being trained with the participation of foreign experts.

It is important that universities and institutes in the field of pedagogy are involved in these processes, and the methodology of training pedagogues is being updated. The most important thing is that today the greatest attention is paid to primary education, the reconstruction of pre-school educational institutions in rural areas, the provision of the necessary inventory, equipment, teaching-methodical manuals and multimedia tools. is aimed at radically improving the quality of preparing children for school, applying modern approaches to the processes of raising and teaching kindergarten

children, creating all the conditions for the intellectual, moral, aesthetic and physical development of children. As a result of this, today the coverage of children in kindergartens has exceeded 60 percent.

Rapid reforms in the education system are based on the approval of the Concept of Development of the Public Education System of the Republic of Uzbekistan until 2030, which defines the main directions of the long-term development of the public education system. in improving the legislation on education, providing education to school-aged children in accordance with the requirements of the time, using advanced foreign experiences, ensuring the quality of education, giving freedom to students in the educational process, creating opportunities for their independent work a number of tasks that cannot be postponed are also appearing.

In particular, today, the low level of use of modern information and communication technologies in the process of organizing the state education services does not allow to ensure the effective implementation of the adopted decisions. Also, the insufficient development of social and public-private partnership in the education system limits the participation of business entities in solving problems in the field of education. Cases where the number of students in some schools has increased to such an extent that the quality of the educational process in the classroom has decreased sharply, the admission of children to educational institutions and the complete elimination of elements of various forms of corruption in the educational process. the introduction of effective mechanisms and the formation of strong motivation for students to learn is also a requirement of the time.

Well, it is natural that many people are interested in what is the experience of the countries of the world in terms of upbringing and education, in which country of the world education and education have been developed perfectly, to what extent the legal foundations of the system have been formed. Japan is an example in this regard. If we pay attention to the educational system, educational processes, legal foundations of education, and the content of education, we can see that many achievements have been achieved in them precisely through the reform of the educational system. It should be noted that in Japan it is established that all children must receive free general education, like ours. The Japanese education system consists of such divisions as kindergarten, elementary school, junior high school, senior high school, and higher education.

The Japanese believe that the child's behavior and behavior culture should be developed, and the main attention is paid to the upbringing of children, that is, students should respect others and be kind, noble and considerate to nature. is required.

And in the process of teaching, in most cases, they use the method of discussing problems and teaching each other using the game method, rather than memorizing the

textbook. It was found that when using the method of discussions and teaching each other, the child remembers up to 90% of the information, and up to 40% if the teachers teach only in the lecture style.

Everyone has an answer to the question of what the approach to upbringing and education with such attention and great responsibility gave to Japan. To be more precise, it is correct to say that these reforms in the field of education made it possible for Japan to quickly become one of the most economically developed countries due to strict discipline in the field of education and training.

Now, while continuing the rapid reforms in the field of upbringing and education, first of all, by forming national feelings such as correctness, honesty, hard work, and patriotism in our children, and by teaching them to be independent thinkers, making extensive use of advanced foreign experiences, we will succeed in educating brave children who are correct and educated, ready to serve for the development of the Motherland.

The task was to increase the activity of a person through the innovations introduced into the education system, to discover new features and abilities based on the application of innovative technologies. It was necessary to determine the following tasks for the transition to pedagogical technologies: diagnosis, planning and setting a specific goal. In the traditional educational process, importance is mainly attached to the teacher's personality and his skills. For this, it is important for him to be experienced and have professional qualifications. And in the application of pedagogical technologies, by designing the educational process, the pedagogue can achieve educational efficiency in a short time without getting tired mentally and spiritually.

The quality of the educational process at school depends on many factors, among which the methods and methods of teaching are of decisive importance. Consequently, they have a positive effect on the conscious and deep assimilation of knowledge, the development of independence and creative activity in students. The concepts of method and method are interrelated, because each of them appears as a method and as a method. A great wealth of teaching methods and methods has been accumulated in pedagogical practice. When choosing them, various conditions, the nature of the taught subject, children's age characteristics, the level of previous training and other factors are taken into account. The choice of methods and methods depends on the problem that the teacher intends to solve in the lesson. For example, if the same methods are used to describe new material, different methods are used to strengthen it and summarize its content. Although there are many methods and methods in the work of each teaching, the goal of their application is to activate the educational work of the student. This activity is very important, firstly, it turns students into their faith, and faith into

practical activity and behavior, and secondly, it facilitates the work of the teaching process. After all, reading and learning is a complex activity that requires attention and requires a sharp mind, strong will, clear imagination, and strong memory.

The task of the teacher is to develop these qualities in students using effective methods and methods and to teach them to overcome difficulties.

Certain requirements are imposed on teaching methods:

✓ The dialectical-materialistic way of thinking recommended by the teacher should lead to the formation of independent views, volitional characteristics and behavior. From the point of view of this demand, the method should be educational.

✓ The scientific basis of the teaching method must be clear and precise. Only then will the teacher be able to see what problems can be raised and solved by this method, and what problems cannot be solved.

✓ The system of teaching determines its effectiveness.

✓ Comprehensibility of the teaching method, it is necessary that the way of teaching is accepted and used by the student, and the method of studying the educational material is in accordance with the possibilities of acquiring knowledge.

✓ The need for awareness and activity in teaching is a very serious requirement.

✓ Accuracy and validity of knowledge.

✓ Compatibility of theoretical and practical events in teaching methodology.

Any method is intended to achieve a goal, and therefore it requires setting a goal, a method of activity to achieve it, and knowing the tools that will help in the implementation of this activity. Any activity requires its object. Finally, the method must lead to the goal, otherwise it must be recognized that the goal for which it was set is invalid, or, in this case, that it has been completely misused.

Teaching methods can be divided into:

1. Ways that form and activate separate operations of thinking, memory, attention and imagination;
2. Methods that activate students' experiences and emotions related to mastering the learning material;
3. Methods of control and self-control of students;
4. Methods of managing students' collective and personal interactions during the teaching process.

The interactive method in education means strengthening and activating the relationship between the student and the teacher. Today, in the era of rapid development of science and technology and the transition to a market economy, in the era of changing social conditions, new teaching of education in schools, especially primary education, in terms of content, is a necessity and a requirement of the times.

In conclusion, we can say that the technological training of the primary school teacher requires the effective use of elements of pedagogical technology in the course of the lesson.

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SOFTENED WOOL AND OTHER FIBERS MIXTURE TECHNOLOGICAL PROPERTIES

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Abstract. *This in the article softened sheep wool other fibers — viscose , polyester and natural fibers with mixed in the state technological properties studied . Mixed in the composition of fibers flexibility , one diversity , physical-mechanical connection level and flexibility analysis The research was conducted results mixture fibrous products working optimal proportions in production definition , product quality increase and energy economical technologies in use important importance has .*
Keywords *: softened wool , blend , technical properties , viscose , polyester , elasticity , quality*

Blending softened sheep wool fibers with synthetic (polyester, acrylic) and natural (cotton) fibers is widely used in today's textile industry. This process serves to combine the advantages of both fibers and improve the quality of the product.

1. Softened wool + Polyester (PET) fiber blend balances the natural heat retention properties of wool + the durability and hygroscopicity of polyester. The properties of the Softened wool + Polyester (PET) fiber blend are presented in Table 4.9.

Table 1

Properties of a blend of softened wool + Polyester (PET) fibers

Indicators	The mixture feature
Mechanical strength	Very high, polyester is tougher and more durable than wool
Hygroscopicity	Through the wool stored (polyester to low hygroscopicity owner)
To wash endurance	30–40% polyester , high- quality is saved
In the product shrinkage	Will be reduced (the natural wrinkling of the wool will be reduced)

Aesthetic appearance	Shiny , soft , hardness and elasticity balanced
Processing temperature	Polyester top at temperature melting possible (max. 180°C), caution need
70% Wool + 30% Polyester	the heat protective and the resulting product is durable
30% Wool + 70% Polyester	economical , light , high resistant to processing

The properties of the softened wool + Acrylic (PAN – polyacrylonitrile) blend are presented in Table 4.10.

Acrylic is called "synthetic wool." When used with wool, the price of the product decreases and washing becomes easier.

Table 1.2

Properties of the softened wool + Acrylic (PAN – polyacrylonitrile) blend

Index	The mixture feature
Softness	Very high, a krill and softened wool to each other suitable
Heat to keep	Acrylic and wool together provides good insulation
In the wash unexpected contraction	Low (acrylic wool) stabilizes)
To the pilling inclination	In acrylic pilling (collection points) is at risk
Hypoallergenicity	Acrylic allergies possible – caution need
60% Wool + 40% Acrylic	more naturalness keeps
50/50	light , washable durable product
30% Wool + 70% Acrylic	cheap and a very soft product is obtained

3. The properties of the softened wool + cotton blend are given in Table 1. This fiber product is heat-resistant, breathable, lightweight, and highly hygroscopic.

Table 1.3

Indicators	Properties of the mixture
Hygroscopicity	Both fibers absorb moisture well.

Softness	High softness based on softened wool
Heat preservation	Wool is good for the price, but cotton doesn't retain heat.
Cleaning and washing	Low shrinkage in washing, easy to release oil
Hypoallergenicity	Natural fibers are comfortable for human skin
70% Wool + 30% Cotton	A warm and soft product is obtained
30% Wool + 70% Cotton	It is intended for the production of light summer products

The results of the comparison of the general properties of the mixture are presented in Table 4.12.

Table 1.4

Results of a comparison of properties of softened wool and other fiber blends

Components	Heat	Softness	Hygroscopicity	Stability in washing	Aesthetics	Price
Wool + Polyester	●	●●	●●	●	●●●	Average
Wool + Acrylic	●●●	●	●●	●●●	●●●	Cheap
Wool + Cotton	●●●	●●●	●	●●●	●●●	More expensive

In conclusion, it can be shown that softened sheep wool is polyester Mixing with - for durable, wash-resistant and economical products, acrylic Blending with cotton is preferable for producing soft and inexpensive products, while blending with cotton is preferable for producing hygienic and skin-friendly, high-quality products.

Soft sheep wool, polyester , PAN (acrylic) and cotton fiber dyeing process and parameters

1. Dyeing of softened sheep wool and polyester fibers is carried out in 2 stages. Since wool is a hydrophilic, natural protein-based fiber, and polyester (PET) is a hydrophobic, synthetic polyester fiber, both fibers have different chemical natures, and therefore are dyed at different dyes and temperatures. The types of dyes for dyeing sheep wool fibers and polyester are given in Table 1.5.

Table 1.5

Types of dyes used for dyeing wool and polyester

Fiber	Paint type

Sheared and softened sheep's wool in the autumn season	Acid (acid), and
acetic acid	1–2%
sulfate salts	0.5%
Polyester fiber	Dispersion
Temperature, °C	70
Storage in motion at the specified temperature, time, min	40
Demineralized water, liter	100

2. Dyeing softened sheep wool and Acrylic (PAN) fibers cannot be dyed at the same time **because** the two fibers have different chemical properties. Therefore, separate two-stage dyeing is recommended.

The parameters of dyes used for dyeing softened sheep wool and Acrylic (PAN) fibers are presented in Table 1.6.

Table 1.6

Dyeing parameters for softened sheep wool and acrylic (PAN) fibers

Step	Temperature	pH	Time	Paint type
1. Dyeing wool	85–95°C	4.5	30–40 min	Acetic acid, chlorides as acid dye and catalyst
2. Acrylic painting	95–105°C	3.5–4.5	20–30 min	As a basic dye and catalyst, dispersants, stabilizers

3. It is possible to dye softened sheep wool + cotton blend fibers in one step , for which a reactive-acid mixture dye should be used. The dyes and parameters used for dyeing softened sheep wool + cotton blend fibers in one step are also presented.

Table 1.6

Dyes and parameters used for one-step dyeing of sheep's wool + cotton blend fibers

Fiber content	Paint type and parameters
Wool + Cotton	Acid + Reactive dyes
Temperature, °C	80
Storage in motion at the specified temperature, time, min	40

Regarding fiber dyeing, it can be concluded that dyeing wool and polyester fibers is difficult, has poor mechanical strength and aesthetic appearance, while dyeing wool and acrylic is not difficult, the resulting product is soft and inexpensive, and although it is more difficult to dye wool and cotton, the product produced from it is hygienic and natural.

Economic efficiency of research

By softening the wool fiber, the improvement of its physical and mechanical parameters, as well as the increase of efficiency in technological processes, bring significant economic benefits.

After the softening process, the strength of the wool fiber is increased, the length and uniformity of the fiber is improved, the fiber is thinner and more elastic, and it is cleaned from impurities. Processing requires less energy and time, and allows for a higher quality product.

The following formula is used to determine economic efficiency:

$$\textit{Economic efficiency (in soums)} = \textit{(High-quality product output difference)} \times \textit{(1 kg product price)} - \textit{Mitigation costs}$$

Based on the result of softening 1 ton of spring wool in Bukhara region, it was calculated using the values given in table 4.9.

Table 1.7

Indicator name	**Unbleached wool**	**Softened wool**
Product output from sheared wool	60%	75%
Price of 1 kg of finished yarn	80,000 sum	80,000 sum

Softening costs (for 1 t of wool)	-	4,000,000 sum

Output of wool fiber from 1 ton of wool without softening:
1000 kg×60%=600 kg
Fiber output from 1 ton of softened wool:
1000kg×75%=750kg
Difference: 750−600=150kg

Difference in income (profit): 150kg×80000 soum=12000000 soum

Economic efficiency:

12000000 soums (income)−4000000 soums (expenses)=8000000 soums profit

By softening 1 ton of wool, you can get a profit of about 8 million soums. This will simultaneously increase processing efficiency, improve product quality, and allow you to sell it on the market at competitive prices .

Summary for Chapter 4:

1. In conducting a full-scale experiment, the adjustment factors in the wool fiber processing equipment were thoroughly studied and X_1 - the speed of the cleaning-cleaning drum, rpm, X_2 - the rotation speed of the fan, rpm, X_3 - the mass of the emulsion content, % were chosen as the input factors. U_1 - fiber diameter, micron, U_2 - strength, sN/mtex, U_3 - fiber elasticity, %, U_4 - fiber elongation at break, % properties were selected as output parameters .
2. It was found that in order to obtain high results in terms of diameter, strength, fiber elasticity, and elongation at break of softened karakul sheep wool fibers as a result of processing wool fibers shorn in the autumn season, it is necessary to set the X_1 - cleaning drum speed to 800 rpm, X_2 - fan rotation speed to 1500 rpm, and X_3 - emulsion composition Ciba Sapamine OC - 2 kg, Triamon - 3 kg .
3. Since the multivariate regression models for $F_R^{/}<F_T$ бsoft wool sheared in the autumn season were dead , the hypothesis that the model obtained under the effect of the output parameter is significant, was not rejected.
4. Softened sheep wool polyester Mixing with - for durable, wash-resistant and economical products, acrylic Blending with cotton was considered preferable for soft and inexpensive products, and blending with cotton was considered preferable for the production of hygienic and skin-friendly, high-quality products.
5. Dyeing wool and polyester fibers is difficult, but they have mechanical strength and aesthetic appearance. Dyeing wool and acrylic is not difficult, the resulting product

is soft and inexpensive. Although it is more difficult to mix wool with cotton, the product made from it is hygienic and natural.

shorn in the fall , an economic benefit of 8 million soums can be achieved due to increased efficiency and improved product quality. This will allow the softened wool shorn in the local fall to be sold at competitive prices in the market.

The research demonstrated that blending softened sheep wool with synthetic and natural fibers such as polyester, acrylic (PAN), and cotton provides significant improvements in the technological properties and economic efficiency of textile products. Experimental analysis confirmed that each blend offers specific advantages depending on the fiber ratio. A wool–polyester blend produced durable, wash-resistant, and cost-effective fabrics, where 70% wool + 30% polyester ensured heat retention and strength, while 30% wool + 70% polyester resulted in lighter, economical fabrics with high processing resistance. Wool–acrylic blends delivered excellent softness and insulation at lower cost, though pilling tendency and possible allergenic effects require consideration. A 50/50 composition yielded washable, durable textiles, while higher acrylic content enhanced softness and affordability. Wool–cotton blends provided superior breathability, hygroscopicity, and skin comfort, making them ideal for hygienic, high-quality products; however, they are relatively more expensive. Dyeing analysis revealed that wool–polyester blends require two-stage processing due to their differing chemical natures, making coloration more complex but aesthetically attractive. Wool–acrylic blends are comparatively easier to dye, producing soft and inexpensive outcomes, while wool–cotton blends can be dyed in a single step using acid–reactive combinations, yielding natural, hygienic fabrics. From an economic perspective, softening wool significantly increased processing efficiency and product quality. Calculations showed that processing one ton of softened wool in Bukhara increased fiber yield from 600 kg to 750 kg, generating an additional profit of about 8 million UZS. Furthermore, optimal machine parameters (800 rpm cleaning drum speed, 1500 rpm fan speed, and specific emulsion composition) improved fiber diameter, strength, elasticity, and elongation at break.

In conclusion, blending softened wool with polyester, acrylic, or cotton enables the production of high-quality, energy-efficient, and market-competitive textiles. These findings demonstrate practical solutions for modernizing the Uzbek textile industry and enhancing global competitiveness.

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"Development of high-quality yarns from wool–acrylic and wool–polyester blends for the Textile Industry"

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Annotation *The modernization of Uzbekistan's textile sector requires comprehensive analysis of blended yarn quality and performance. This research focuses on the structural and mechanical characterization of yarns produced from local Karakul wool blended with polyester and acrylic fibers. Advanced laboratory instruments, including Uster Tester-5, Statimat-C, and SEM imaging, were employed to evaluate tensile strength, elongation, evenness, and surface morphology. The results demonstrated that wool-polyester blends possess superior durability, while wool-acrylic yarns exhibit greater softness and warmth retention. By applying systematic testing and comparative evaluation, this study provides critical insights into optimizing yarn properties and ensuring high-quality standards in Uzbekistan's textile industry.*
Keywords *Wool, Karakul sheep, Polyester, Acrylic, Yarn testing, Mechanical properties, Tensile strength, Elongation, Evenness, SEM analysis, Yarn morphology, Fiber structure, Textile quality, Uster Tester, Statimat-C, Durability, Softness, Blended yarns, Uzbekistan, Structural analysis, Performance evaluation.*

The present research highlights the importance of developing high-quality yarns from wool–acrylic and wool–polyester blends for advancing Uzbekistan's textile industry. Local Karakul sheep wool, although abundant and unique in its thermal and elastic properties, has long remained underutilized due to its coarseness and low spinnability. By blending it with synthetic fibers such as acrylic and polyester, many of these limitations can be overcome, resulting in yarns that combine the advantages of both natural and synthetic components.The findings of this study confirm that wool–acrylic blends provide superior softness, elasticity, and warmth retention, making them highly suitable for winter clothing and fashion textiles. On the other hand, wool–polyester blends demonstrate enhanced durability, abrasion resistance, and dimensional stability, making them favorable for industrial and technical fabrics. Such diversity of application areas highlights the flexibility and commercial potential of blended yarn production.Moreover, modern spinning techniques and fiber treatment methods, including emulsification, have proven effective in improving the compatibility of wool with synthetic fibers.

*I*n this case, the wool fiber is less damaged during mechanical processing by **cleaning** and **softening** , while the synthetic fiber increases the strength and elasticity of the yarn. Thus, **50% wool + 50% acrylic** and **40% wool + 60% polyester** blends can be used to produce threads for various purposes.

In the stages of raw material preparation, the average length of the cleaned and softened wool fibers is determined first, accordingly, acrylic fiber (PAN - polyacrylonitrile) and **polyester fiber** (PET - polyethylene terephthalate) are cut into uniform sections, 38–51 mm long, and an emulsion is prepared according to the recipe given in Tables 2.1-2.2, each fiber is sprayed with the emulsion layer by layer, allowed to rest for 24 hours, and dried while maintaining 10% moisture. Then, the first composition of **50% karakul wool + 50% acrylic** fibers and the second composition of **40% karakul wool + 60% polyester fibers are separately subjected to** the mixture **preparation - cleaning process and** uniform distribution is ensured in the mixing machine.

Mixture fibers **to comb the hair to the car** is transmitted .At this stage threads spread, parallel to the situation is brought , ч of the results remainder part is thrown out , first wick harvest will be Additional combing is used to mix and make the fibers uniform.The 4 rovings are combined and aligned to create a uniform mass and unidirectional fiber flow and to increase the parallelism of the fibers in the direction . The rovings are turned into rovings with a slight twist in **the roving machine** . The roving is an intermediate product ready to be spun into yarn. A ring spinning machine or a pneumatic spinning **machine is used** to spin yarn can be applied.

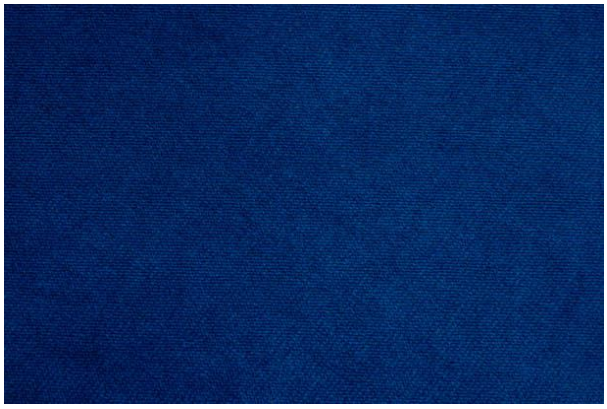
Ring spinning - for thin, strong and soft yarns, **Rotor spinning** - faster, cheaper and more consumer-friendly yarns are obtained. In a 50% wool + 50% acrylic blend, the yarn thickness (tex) and twist coefficient (α) are selected close to natural fibers. In **a 40% wool + 60% polyester** blend, the twist is less due to the high polyester content, but the strength is higher and **The properties of a 50% wool + 50% acrylic blend yarn** are high in softness, because acrylic fiber is a fiber similar in nature to wool, has good **heat retention** , high **color acceptance** (acrylic does not bleed when dyed), and the yarn structure is voluminous and breathable. **40% wool + 60% polyester blend yarn has high strength and durability** , due to the polyester content, it has the ability **to shrink as a result of wetting** , heat preservation is provided by the contribution of wool, it does not lose its shape in the long term.

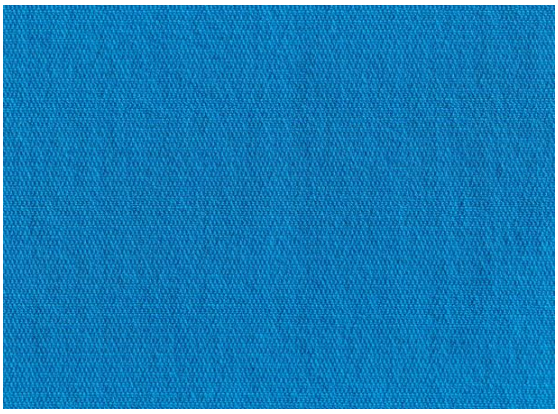
Wool, polyester and acrylic blended yarns.

Picture.1-1.1

Suit fabric woven from a blend of 50% wool and 50% acrylic yarns.

Picture.2-2.1





In this technology, cleaned, softened karakul wool fiber is mixed with synthetic fibers in an optimal percentage to obtain high-quality yarn. While a wool-acrylic blend is suitable for soft and warm products (pullovers, scarves, children's clothing), a wool-polyester blend is recommended for durable and shape-retaining products (suits, coats, workwear). The technology developed for obtaining yarns with wool-acrylic and wool-polyester blended fibers is presented in Figures 3.-3.1.

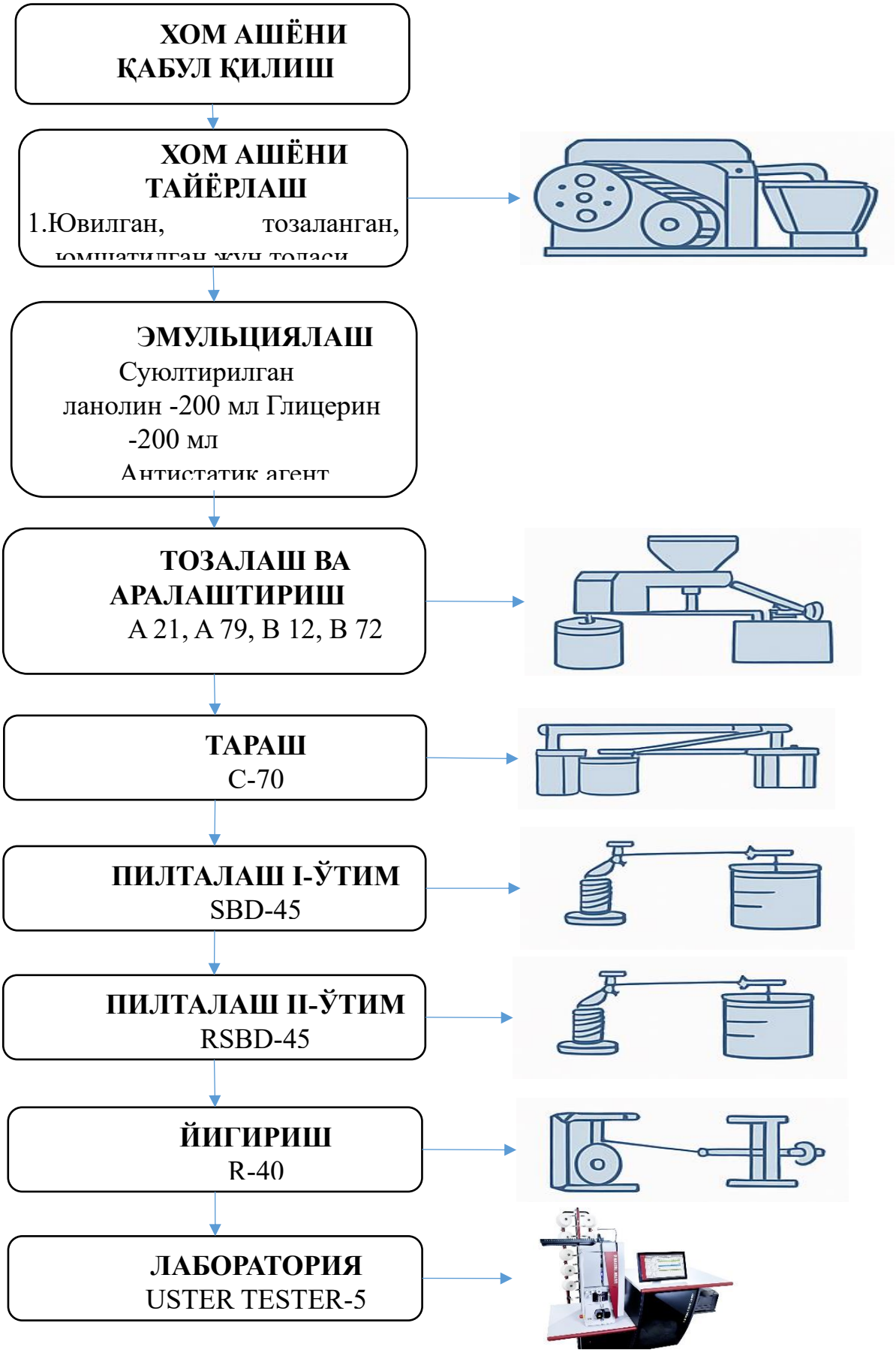


Figure 3. Option 1 technology for producing woolen yarn.

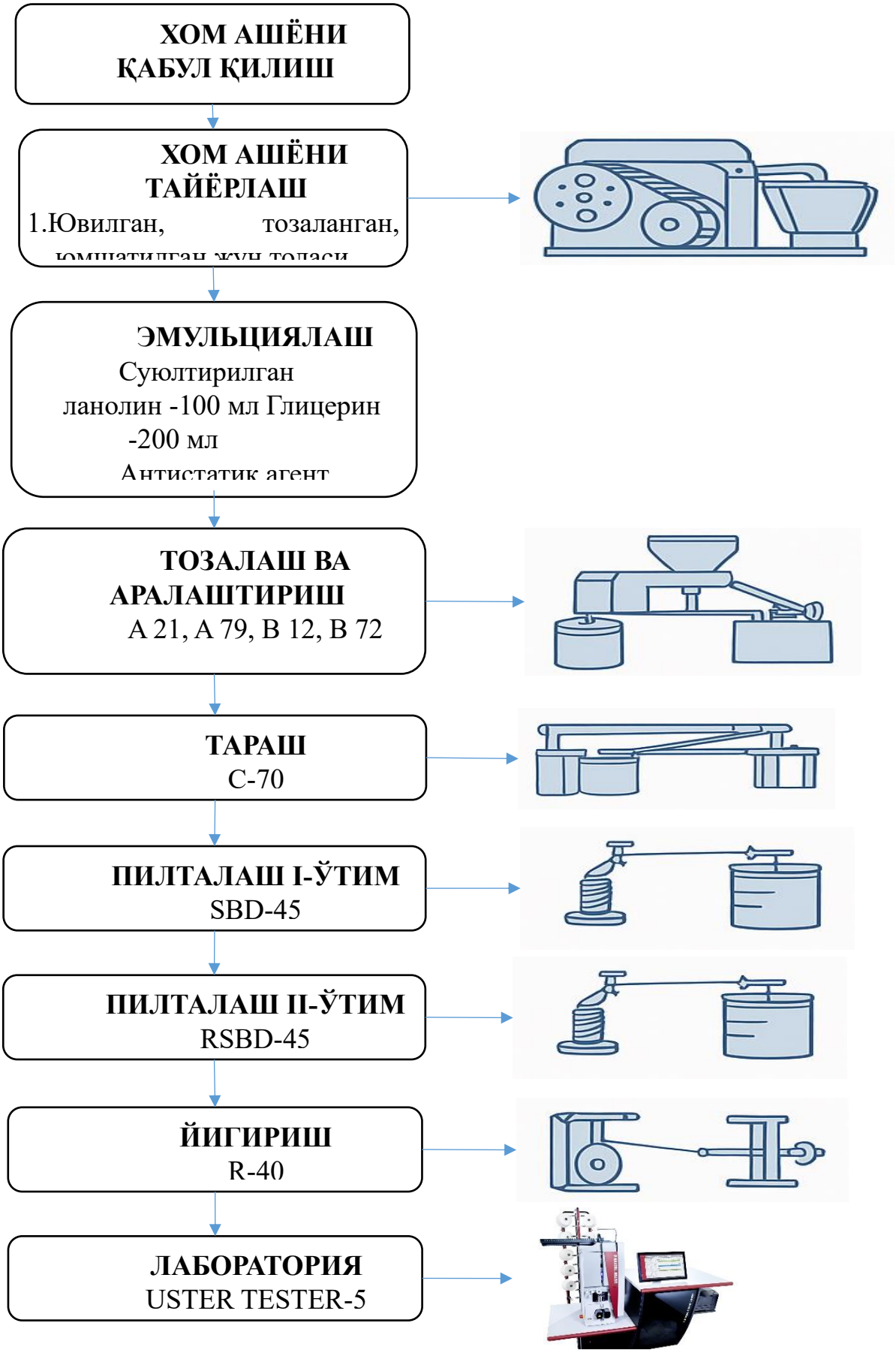
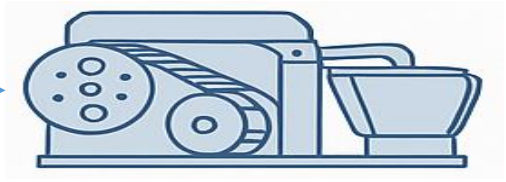


Figure 3.1. Technology for producing wool-acrylic blended yarn for option 2.

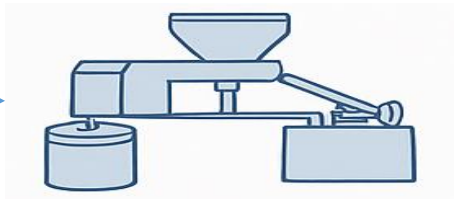
ХОМ АШЁНИ ҚАБУЛ ҚИЛИШ

ХОМ АШЁНИ ТАЙЁРЛАШ
1.Ювилган, тозаланган,
юмшатилган жун толаси

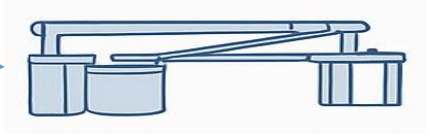


ЭМУЛЬЦИЯЛАШ
Суюлтирилган ланолин -80 мл Глицерин -250 мл
Антистатик агент

ТОЗАЛАШ ВА АРАЛАШТИРИШ
A 21, A 79, B 12, B 72



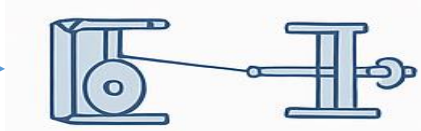
ТАРАШ
C-70



ПИЛТАЛАШ I-ЎТИМ
SBD-45

ПИЛТАЛАШ II-ЎТИМ
RSBD-45

ЙИГИРИШ
R-40



ЛАБОРАТОРИЯ
USTER TESTER-5

Figure 3.2. Technology for producing wool-polyester blended yarn for option 3.

The strength (tensile strength) and elongation at break of yarns with different compositions obtained on the basis of the developed technology were determined on the "Uster-Tester-5" equipment, the results are presented in Table 1 and Figures 3.1-3.2

Table 1

Changes in the physical and mechanical properties of yarns with different fiber content

Indicator name	100% wool	50% wool+ 50% acrylic	40% wool+ 60% polyester
	Option 1	Option 2	Option 3
Tensile strength, sN	378.25	481.6	506.8
Coefficient of variation in tensile strength, %	12.75	11.14	9.34
Elongation at break, %	17.13	17.21	18.82
Coefficient of variation in elongation at break, %	12.4	15.39	12.68
Relative breaking strength, sN/tex	8.2	9.5	10.1
Coefficient of variation in relative breaking strength, %	12.75	11.75	9.34

Brought table information of wool yarn break strength, breaking strength elongation level and their one such as flatness (coefficient of variation) . basic mechanical properties to study the results illuminating gives These indicators fabric work to release technological processes , in particular weaving in mechanical effects of the material endurance and processing to give characteristic determination for important to the point owner .

The highest breaking strength (506.8 sN) from 40% wool and 60% polyester note in the 3rd option The lowest indicator and (378.25 sN) 100% wool silk correct will come This is the following explained by facts : polyester synthetic fiber high to patience owner is the mechanical strength of the wool yarn noticeable to the extent increases . Acrylic too to strength contribution in addition to polyester relatively to him/her relatively little lower Q is funny aspect , synthetic fiber threads only their own high strength without adding stability both they increase . of the coefficient of variation decrease (12.75% → 9.34%) of results of the spread decreasing and thread of the quality improved , that is of silk all in part one flat high to strength owner that it is shows .

Overall, the research underscores the strategic role of wool-based blended yarns in diversifying Uzbekistan's textile exports, reducing dependency on imported fibers, and increasing the added value of local raw materials. By integrating scientific approaches with industrial practices, the country has the potential to create globally competitive products while fostering sustainable use of its natural resources. Future studies may focus on expanding the range of synthetic blends, exploring eco-friendly finishing technologies, and applying advanced testing methods to further optimize yarn performance.

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On the method for calculating the trace formulas of the fractional Sturm-Liouville operator

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The trace formulas of linear differential operators deeply reveal the structure of the spectrum of differential operators and have important applications in the numerical calculation of eigenvalues, the theory of inverse problems, and the theory of solitons. For the first time in work [1], a regularized trace for the Sturm-Liouville operator is calculated. This result was generalized by many authors, and methods were developed for generalizing this formula to the case of other operators [2-4]. The trace formulas for the conformable fractional Sturm-Liouville problem was studied in [5].
In this paper, we present a new approach for obtaining the trace formula for the conformable fractional Sturm-Liouville problem.

We consider the conformable fractional Sturm-Liouville problem

$$\begin{cases} l_\alpha y := -D_x^\alpha D_x^\alpha y + q(x)y = \lambda y \\ D_x^\alpha y(0) - hy(0) = 0 \qquad\qquad 0 < x < \pi \\ D_x^\alpha y(\pi) - y(\pi) = 0 \end{cases}$$

where λ is a spectral parameter and $q(x)$ is a real continuous function. In (1), $D_x^\alpha y$ denotes the fractional derivative defined as follows:

Definition. Let $f:[0,\infty) \to R$ be a given function. Then, the conformable fractional derivative of f of order α is defined by:

$$D^\alpha f(x) = \lim_{h\to 0} \frac{f(x + hx^{1-\alpha}) - f(x)}{h}, \qquad (1)$$

for all $x > 0$, $\alpha \in (0,1]$.

For more information about conformable fractional derivative see [6-7].

Let consider the following (1) Dirichlet boundary value problem

Theorem. The following trace formula is hold

$$\sum_{n=0}^{\infty}\left[\lambda_n - \frac{\alpha^2}{\pi^\alpha}n^2 - c_0\right] = \frac{q(0)+q(\pi)}{4} - \frac{1}{2}c_0 - \frac{\alpha}{\pi^\alpha}(h+H) - \frac{1}{2}(h+H)^2$$

Where

$$c_0 = \frac{\alpha}{\pi^{\alpha}} \int_0^{\pi} q(t) d_{\alpha} t$$

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РАЗРАБОТКА ПРОГРАММНОГО ОБЕСПЕЧЕНИЯ ДЛЯ ЧИСЛЕННОГО РЕШЕНИЯ ОБРАТНЫХ ЗАДАЧ ДЛЯ НЕЛИНЕЙНЫХ ЭВОЛЮЦИОННЫХ ВИХРЕВЫХ УРАВНЕНИЙ

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Цель исследования

Цель исследования — разработка программного обеспечения, позволяющего эффективно и точно решать обратные задачи для нелинейных эволюционных вихревых уравнений. В ходе работы предполагается создание алгоритмов для стабильного вычисления неизвестных параметров вихревых систем, оптимизация численных методов и обеспечение удобного интерфейса программы для пользователя.

Материалы и методы

В качестве материалов исследования использовались: нелинейные эволюционные вихревые уравнения с различными параметрами; исходные и граничные условия, а также синтетические тестовые данные; результаты численных экспериментов для проверки точности и стабильности программы.
Методы исследования:

1. Математическое моделирование – формализация обратных задач и определение неизвестных параметров;
2. Численные методы – использование конечных разностей (Finite Difference Method, FDM), регуляризация Тихонова и итерационные алгоритмы для повышения точности;
3. Алгоритмическое моделирование – разработка структур программного обеспечения для оптимизации вычислений и проверки устойчивости;
4. Экспериментальная проверка – проведение тестов на различных конфигурациях вихревых систем для оценки точности и надежности расчетов;
5. Анализ результатов – сравнение полученных решений с теоретическими данными и визуализация динамики вихревых полей.

Применение этих методов обеспечивает эффективное и устойчивое решение сложных нелинейных обратных задач с высокой точностью.

Результаты

Разработанное программное обеспечение успешно решало сложные нелинейные обратные задачи. В ходе тестов относительная ошибка определения неизвестных

параметров не превышала 2–3%, что подтверждает высокую точность алгоритмов. Даже при добавлении шумов до 5% в исходные данные программа сохраняла устойчивость, обеспечивая стабильную сходимость итераций без колебаний. Для пространственной сетки 100×100 узлов и временного шага $\Delta t = 0.01$, расчетные эксперименты выполнялись за 45–60 секунд на стандартном компьютере (Intel i7, 16 GB RAM). Интерфейс программы позволял строить графики вихревого поля в реальном времени, сравнивать вычисленные и исходные данные, что облегчало анализ результатов. Итерационный градиентный метод обновления параметров показал высокую скорость сходимости даже для сложных нелинейных задач. Результаты экспериментов подтвердили, что разработанное программное обеспечение обеспечивает высокую точность, устойчивость и эффективность вычислений, что делает его практическим инструментом для решения обратных задач в нелинейных вихревых системах.

Выводы

В результате проведенного исследования было разработано программное обеспечение, обеспечивающее эффективное, точное и устойчивое решение обратных задач для нелинейных эволюционных вихревых уравнений.

Применение численных методов, включая конечные разности и регуляризацию Тихонова, позволило получать надежные решения даже при наличии шумных данных. Интерфейс программы обеспечивает удобное управление параметрами, визуализацию вихревого поля и анализ результатов в реальном времени. Разработанное программное обеспечение имеет практическую и научную ценность, предоставляя исследователям инструмент для моделирования сложных вихревых систем и точного определения неизвестных параметров. В дальнейшем программа может быть дополнена интеграцией параллельных вычислений и методов машинного обучения для оптимизации параметров, что повысит производительность и расширит возможности применения.

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ФОРМИРОВАНИЕ КРЕАТИВНОГО МЫШЛЕНИЯ МЛАДШИХ ШКОЛЬНИКОВ В РАМКАХ ВНЕУРОЧНОЙ ДЕЯТЕЛЬНОСТИ

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Аннотация: В современном образовательном процессе особое значение приобретает развитие креативного мышления как одного из ключевых навыков XXI века. Младший школьный возраст представляет собой наиболее благоприятный период для формирования основ творческого мышления, так как именно в это время активно развиваются воображение, интуиция, гибкость и самостоятельность. В данной статье рассматриваются особенности формирования креативного мышления младших школьников в рамках внеурочной деятельности, которая предоставляет свободное пространство для творческой самореализации детей. Внеурочная деятельность позволяет использовать нестандартные методы, игровые и проектные технологии, элементы искусства, исследовательскую и конструктивную деятельность, что способствует формированию у учащихся способности к дивергентному мышлению, самостоятельному решению нестандартных задач и созданию оригинальных идей. Особое внимание уделено роли педагога в организации развивающей среды и выборе эффективных форм внеурочной работы.

Ключевые слова: креативное мышление, младшие школьники, внеурочная деятельность, творчество, педагогические технологии, игра, проектная деятельность, развитие личности, нестандартное мышление, дивергентное мышление.

Введение

Современное общество предъявляет всё более высокие требования к личности, способной адаптироваться к быстро меняющимся условиям, мыслить нестандартно, принимать самостоятельные решения и предлагать оригинальные идеи. В этом контексте креативное мышление рассматривается как одна из ключевых компетенций XXI века. В условиях обновлённой системы образования задача развития творческого потенциала учащихся становится неотъемлемой частью педагогического процесса.

Младший школьный возраст — это особый период в жизни ребёнка, когда закладываются основы мышления, формируется познавательная активность и стремление к самовыражению. Именно в этом возрасте дети наиболее восприимчивы к новому опыту, открыты к экспериментам и играм, обладают богатым воображением и естественным интересом к окружающему миру. Поэтому крайне важно использовать данный возрастной этап для целенаправленного развития креативного мышления.

Традиционные формы урочной деятельности, несмотря на свою значимость, нередко ограничены рамками учебной программы и стандартизированными методами. В отличие от этого, внеурочная деятельность предоставляет уникальные возможности для свободной, гибкой и творчески ориентированной работы с учащимися. Внеурочные занятия позволяют педагогу отойти от жёстких регламентов и использовать разнообразные формы: игры, мастер-классы, проектные работы, конкурсы, театральные постановки, исследовательские и творческие лаборатории. Всё это способствует активизации интеллектуального и личностного потенциала детей.

Кроме того, внеурочная деятельность позволяет наладить доверительные отношения между учителем и учеником, создать благоприятную эмоциональную атмосферу, в которой ребёнок не боится проявлять инициативу, фантазировать, пробовать и ошибаться. Именно такие условия являются основой формирования гибкого, нестереотипного, оригинального мышления.

Таким образом, исследование особенностей формирования креативного мышления младших школьников во внеурочной деятельности является актуальной задачей современной педагогической науки и практики. Это направление требует внимания как со стороны теоретиков, так и со стороны педагогов-практиков, так как от качества организации внеурочной работы во многом зависит развитие творческих способностей и формирование конкурентоспособной личности школьника.

Основная часть

Развитие креативного мышления младших школьников во внеурочной деятельности требует комплексного подхода, учитывающего возрастные особенности детей, специфику образовательной среды и потенциал педагогических технологий. Креативное мышление, в отличие от репродуктивного, ориентировано на поиск оригинальных решений, генерацию новых идей, умение смотреть на ситуацию под разными углами. Оно включает такие компоненты, как беглость, гибкость, оригинальность, разработанность (по

Дж. Гилфорду) и активно формируется при наличии условий для свободной, мотивированной и эмоционально окрашенной деятельности.

Одним из таких условий является внеурочная деятельность, где ребёнок выходит за рамки строго учебной программы. Здесь можно варьировать методы, подходы, содержание и формы работы. Педагог может использовать интерактивные методы, игровые технологии, проектную и исследовательскую деятельность, кружковую работу, культурно-досуговые мероприятия. Всё это создаёт благоприятную почву для реализации творческого потенциала младших школьников.

Одним из эффективных подходов является организация кружковой работы с творческой направленностью. Например, кружки театрального искусства, рисования, моделирования, литературного творчества или «Юный изобретатель» не только позволяют ребёнку развивать свои интересы, но и формируют навык нестандартного мышления. В таких условиях дети учатся генерировать идеи, работать в команде, представлять свои разработки, мыслить образно и конструктивно.

Проектная деятельность также широко используется во внеурочной работе. Младшие школьники в рамках мини-проектов создают постеры, проводят простые наблюдения, готовят презентации, моделируют ситуации и ищут альтернативные решения. Важно, чтобы темы проектов были лично значимыми и интересными для детей — это повышает мотивацию и вовлечённость. Например, проекты «Мой волшебный город», «Изобрети полезный прибор для школы», «Придумай свою сказку» активизируют образное мышление и развивают умение видеть привычные вещи в новом свете.

Игровые технологии, особенно творческие и ролевые игры, выступают мощным стимулом развития креативности. Через игру дети свободно выражают идеи, учатся импровизировать, пробовать новое. Такие игры, как «Что было бы, если…», «Придумай финал», «Нарисуй музыку», позволяют выходить за рамки шаблонного мышления. Ролевая игра создаёт условную ситуацию, в которой школьник принимает на себя определённую роль (художника, учёного, писателя) и действует в заданных, но открытых для творчества условиях.

Кроме того, во внеурочной деятельности применяются методы мозгового штурма, ассоциативного рисования, визуализации, сторителлинга, которые помогают детям раскрыть внутренний потенциал, учат анализировать, комбинировать и интерпретировать информацию. Практика показывает, что даже простое задание «придумать необычное применение знакомому предмету»

вызывает бурю идей у младших школьников и способствует развитию дивергентного мышления.

Особое внимание уделяется эмоциональной атмосфере занятий. Внеурочная работа должна быть организована так, чтобы ребёнок чувствовал поддержку, безопасность и интерес к собственным результатам. Нельзя критиковать идеи детей — даже самые необычные или «фантастические» находки могут стать основой для новых решений. Поддержка инициативы, уважение к мнению ребёнка, открытость педагога — важнейшие условия формирования креативности.

Не менее важной является и рефлексия, которая помогает осознать и проанализировать собственную мыслительную деятельность. После выполнения творческого задания педагог может предложить детям обсудить: «Что нового ты придумал?», «Что было сложно?», «Какую идею ты мог бы развить дальше?». Это формирует метапредметные компетенции и способствует развитию самосознания.

Таким образом, внеурочная деятельность — это не просто дополнительное времяпрепровождение, а уникальное пространство для творческого развития ребёнка. Она даёт свободу, возможности и инструменты для формирования креативного мышления, что в свою очередь способствует более полной реализации потенциала младшего школьника как личности и будущего участника общества знаний и инноваций.

Заключение

Формирование креативного мышления у младших школьников является важнейшим направлением современной педагогики, поскольку именно в начальной школе закладываются основы гибкого, нестереотипного и продуктивного мышления. В условиях стремительного развития технологий, цифровизации и необходимости быстрого реагирования на изменяющийся мир, умение мыслить креативно становится неотъемлемым компонентом успешной личности будущего.

Рассмотрение возможностей внеурочной деятельности как среды для развития творческого потенциала показывает, что она обладает рядом уникальных преимуществ. Внеурочная деятельность освобождена от жёстких рамок учебных программ, предоставляет больше свободы педагогу и ученику, создаёт условия для экспериментирования, взаимодействия, личностного роста и самовыражения. В такой среде учащиеся чувствуют себя более раскрепощённо, проявляют инициативу, интересуются новыми идеями и активно включаются в творческие процессы.

Эффективность формирования креативного мышления во внеурочной деятельности обеспечивается при использовании разнообразных методик: творческих и ролевых игр, проектной и исследовательской деятельности, методов мозгового штурма, сторителлинга, визуализации и других педагогических технологий. Эти методы позволяют развивать такие качества, как воображение, оригинальность мышления, способность к ассоциативному и дивергентному мышлению, открытость новому опыту и нестандартным подходам.

Особое значение в этом процессе играет личность педагога. Только мотивированный, творчески мыслящий и чуткий учитель способен организовать развивающую среду, способствовать эмоциональной вовлечённости учащихся и формировать атмосферу доверия и поддержки. Именно педагог выбирает такие формы и методы, которые не просто развлекают, а способствуют формированию глубоких, устойчивых умений мыслить креативно и продуктивно.

Важно отметить, что креативность — это не врождённое качество, доступное немногим, а навык, который можно и нужно развивать с раннего возраста. Внеурочная деятельность становится эффективным инструментом в этом процессе, если она целенаправленно организована, включает в себя элементы новизны, сотрудничества, открытых заданий и свободы выбора.

Таким образом, можно сделать следующие обобщающие выводы:

-неурочная деятельность — это благоприятная платформа для развития креативного мышления;

-разнообразие форм и методов работы обеспечивает включённость и активность младших школьников;

-педагогическая поддержка, положительная эмоциональная атмосфера и признание детских инициатив способствуют формированию уверенности и готовности к творчеству;

-креативное мышление формируется в процессе, требующем системности, педагогического мастерства и ориентации на индивидуальные особенности учащихся.

Развитие креативности младших школьников через внеурочную деятельность не только обогащает образовательный процесс, но и формирует компетентного, инициативного и гармонично развитого человека, готового к вызовам современного мира.

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SUN’IY INTELLEKT VOSITALARI YORDAMIDA MALL-PLATFORMALARDA PLURIMADANIY TOPSHIRIQLARNI AVTOMATIK TAHLIL QILISH

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Annotatsiya. Ushbu maqolada MALL (Mobile-Assisted Language Learning) texnologiyalarining sun’iy intellekt bilan integratsiyasi asosida plurimadaniy topshiriqlarni avtomatik tahlil qilish imkoniyatlari yoritilgan. ChatGPT, Grammarly, TalkPal kabi AI vositalarining til o‘rganishda madaniyatlararo kompetensiyani rivojlantirishdagi roli va ularning O‘zbekiston ta’lim tizimida qo‘llanish istiqbollari tahlil etiladi. Shuningdek, mamlakatda raqamli ta’lim va sun’iy intellekt integratsiyasi til o‘qitish samaradorligini oshirishga xizmat qilishi asoslab berilgan.

Kalit so‘zlar: sun’iy intellekt, MALL texnologiyasi, plurimadaniy kompetensiya, avtomatik tahlil, raqamli ta’lim, madaniyatlararo muloqot, til ta’limi.

Аннотация . В статье рассматриваются возможности интеграции технологий MALL (Mobile-Assisted Language Learning) с искусственным интеллектом для автоматического анализа плюримедийных и плюримаданийных заданий. Анализируется роль таких инструментов, как ChatGPT, Grammarly и TalkPal, в развитии межкультурной компетенции обучающихся и их применение в системе образования Узбекистана. Показано, что интеграция ИИ и цифрового обучения способствует повышению эффективности преподавания иностранных языков и развитию межкультурного взаимодействия.

Ключевые слова: искусственный интеллект, технология MALL, плюримаданийная компетенция, автоматический анализ, цифровое образование, Узбекистан, межкультурная коммуникация, языковое обучение.

Annotation. This article explores the integration of MALL (Mobile-Assisted Language Learning) technologies with artificial intelligence for the automatic analysis of pluricultural and multimodal language tasks. It examines the role of AI tools such as ChatGPT, Grammarly, and TalkPal in developing learners’ intercultural competence and their implementation within Uzbekistan’s educational system. The study concludes that integrating AI with digital learning enhances foreign language teaching effectiveness and fosters intercultural communication skills.

Keywords: artificial intelligence, MALL technology, pluricultural competence, automatic analysis, digital education, Uzbekistan, intercultural communication, language learning.

Bugungi kunda raqamli texnologiyalar va sun’iy intellekt ta’lim tizimining ajralmas qismiga aylanib bormoqda. Xususan, **MALL (Mobile-Assisted Language Learning)** texnologiyalari til o‘qitishning yangi bosqichini boshlab berdi — o‘qituvchi va talaba o‘rtasidagi o‘zaro ta’sir mobil ilovalar, virtual muhit va multimodal kontent orqali amalga oshmoqda. Shu bilan birga, til o‘rganish jarayonining muhim tarkibiy qismi bo‘lgan **plurimadaniy kompetensiyani shakllantirish** masalasi ham zamonaviy texnologiyalar bilan uyg‘unlashmoqda. Bunda o‘quvchi faqat tildagi bilimni emas, balki turli madaniyat vakillari bilan samarali muloqot qilish, ularning qadriyatlarini anglash va o‘zini madaniyatlararo kontekstdagi sub’ekt sifatida namoyon etish imkoniga ega bo‘ladi. Sun’iy intellekt vositalari, jumladan **ChatGPT, Grammarly, TalkPal, Elsa Speak** kabi tizimlar til o‘rganishning samaradorligini oshirib, **plurimadaniy topshiriqlarni avtomatik tahlil qilish** imkonini bermoqda. Bu vositalar nafaqat grammatik xatolarni aniqlaydi, balki nutqning madaniy kontekstga mosligini, muloqot ohangini, so‘z tanlashdagi uyg‘unlikni ham baholay oladi. Bunday texnologiyalar yordamida talabaning muloqotdagi madaniyatlararo sezgirligi, tilga nisbatan refleksiyasi va empatik fikrlash darajasi avtomatik tarzda tahlil qilinadi.

Raqamli transformatsiya jarayonlari ta’lim tizimini tubdan o‘zgartirmoqda. Ayniqsa, **MALL (Mobile-Assisted Language Learning)** texnologiyalarining sun’iy intellekt bilan uyg‘unlashuvi til o‘qitish jarayonini yangi bosqichga olib chiqmoqda. Bugungi kunda mobil platformalar yordamida o‘qituvchi va talaba o‘rtasidagi muloqot multimodal kontent — matn, audio, video va virtual muhit orqali amalga oshirilmoqda. Shu bilan birga, **plurimadaniy kompetensiyani shakllantirish** — ya’ni turli madaniyat vakillari bilan samarali muloqot qilish, ularning qadriyatlarini anglash va madaniyatlararo sezgirlikni rivojlantirish — til o‘rganishning ajralmas qismiga aylanmoqda. Xususan, MALL (Mobile-Assisted Language Learning) texnologiyalari til o‘qitishning yangi bosqichini boshlab berdi — o‘qituvchi va talaba o‘rtasidagi o‘zaro ta’sir mobil ilovalar, virtual muhit va multimodal kontent orqali amalga oshmoqda. Shu bilan birga, til o‘rganish jarayonining muhim tarkibiy qismi bo‘lgan plurimadaniy kompetensiyani shakllantirish masalasi ham zamonaviy texnologiyalar bilan uyg‘unlashmoqda. Bunda o‘quvchi faqat tildagi bilimni emas, balki turli madaniyat vakillari bilan samarali muloqot qilish, ularning qadriyatlarini anglash va o‘zini madaniyatlararo kontekstdagi sub’ekt sifatida namoyon etish imkoniga ega bo‘ladi. Sun’iy intellekt vositalari, jumladan ChatGPT, Grammarly, TalkPal, Elsa Speak kabi tizimlar til o‘rganishning samaradorligini oshirib, plurimadaniy topshiriqlarni avtomatik tahlil qilish imkonini bermoqda. Bu vositalar nafaqat grammatik xatolarni aniqlaydi, balki nutqning madaniy kontekstga mosligini, muloqot ohangini, so‘z tanlashdagi uyg‘unlikni ham baholay oladi. Bunday texnologiyalar

yordamida talabaning muloqotdagi madaniyatlararo sezgirligi, tilga nisbatan refleksiyasi va empatik fikrlash darajasi avtomatik tarzda tahlil qilinadi.

O‘zbekistonda bu jarayonlar **“Raqamli O‘zbekiston – 2030”** strategiyasi va **“Sun’iy intellektni rivojlantirish konsepsiyasi”** asosida tizimli ravishda yo‘lga qo‘yilmoqda. So‘nggi yillarda oliy ta’lim muassasalarida raqamli o‘qitish platformalarini joriy etish, chet tillarni o‘qitishda MALL texnologiyalarini sinovdan o‘tkazish, AI asosida tahlil vositalarini qo‘llash bo‘yicha tajribalar kengaymoqda. Masalan, ayrim universitetlarda til o‘rgatuvchi mobil ilovalar yordamida talabalar nutqini avtomatik tahlil qilish, talaffuzdagi xatolarni aniqlash va madaniyatlararo ifoda uslublarini tahlil qilish imkoniyati yaratilmoqda. Bu holat o‘qituvchining yukini yengillashtirib, baholash jarayonini ob’yektivlashtiradi. Kelgusida O‘zbekistonda MALL va sun’iy intellekt integratsiyasi quyidagi yo‘nalishlarda rivojlanishi kutilmoqda: birinchidan, **AI-integratsiyali baholash tizimlari** yordamida yozma va og‘zaki nutqdagi madaniy moslikni avtomatik aniqlash imkoniyati kengayadi; ikkinchidan, **mahalliy tillar va madaniyat asosida ishlab chiqilgan MALL-platformalar** yaratiladi, bu esa o‘zbek, rus, ingliz va boshqa tillarni o‘rganishda madaniyatlararo o‘zaro ta’sirni kuchaytiradi; uchinchidan, **xalqaro hamkorlik asosida ko‘p tilli mobil ta’lim ekotizimi** shakllanadi, unda O‘zbekistonning milliy qadriyatlari ham global raqamli ta’lim tizimiga integratsiyalanadi.

Xulosa o‘rnida aytish joizki, O‘zbekiston ta’lim tizimida sun’iy intellekt va MALL texnologiyalarining integratsiyasi til o‘qitishning yangi bosqichini boshlab bermoqda. Bu jarayon o‘quvchilarda til bilan bir qatorda madaniyatlararo tafakkur va global muloqot ko‘nikmalarini rivojlantirishga xizmat qiladi. Sun’iy intellekt asosida plurimadaniy topshiriqlarni avtomatik tahlil qilish ta’lim sifatini oshirib, o‘qituvchining ishini yengillashtiradi. Mahalliy sharoitga mos MALL-platformalarni yaratish O‘zbekistonning raqamli ta’lim salohiyatini yanada kuchaytiradi. Natijada, mamlakat raqamli ta’lim va madaniyatlararo kompetensiya rivojida mintaqadagi ilg‘or markazlardan biriga aylanish imkoniga ega bo‘ladi.

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PAST INTERNET SHAROITIDA MASOFAVIY ESP TA'LIMDA SUN'IY INTERNET ASOSIDAGI OG'ZAKI NUTQ MASHQLARINI SAMARALI TASHKIL ETISH

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Annotatsiya. Mazkur tezisda past internet sharoitida masofaviy ESP ta'limida sun'iy intellekt asosida og'zaki nutq mashqlarini samarali tashkil etish masalasi yoritilgan. Taklif etilgan metodik model soddalashtirilgan AI vositalari yordamida talabalarda kontekstga mos, refleksiv va kommunikativ og'zaki nutqni shakllantirish imkonini beradi. Ushbu yondashuv texnik cheklovlarga qaramay, masofaviy o'qitish sifatini oshirish va raqamli pedagogikaning yangi bosqichini shakllantirishga xizmat qiladi.
Kalit so'zlar: masofaviy ta'lim, ESP, sun'iy intellekt, og'zaki nutq, past internet, metodik model, refleksiya, kommunikativ kompetensiya.
Аннотация. В данной статье рассматривается проблема эффективной организации устных упражнений на основе искусственного интеллекта в дистанционном обучении ESP при условиях низкой скорости интернета. Предложенная методическая модель позволяет формировать у студентов контекстуально адекватную, рефлексивную и коммуникативную устную речь с использованием упрощённых AI-инструментов. Такой подход способствует повышению качества дистанционного обучения и формированию нового этапа цифровой педагогики, несмотря на технические ограничения.
Ключевые слова: дистанционное обучение, ESP, искусственный интеллект, устная речь, низкая скорость интернета, методическая модель, рефлексия, коммуникативная компетенция.
Annotation. This article addresses the issue of effectively organizing AI-based oral speaking exercises in distance ESP education under low-bandwidth internet conditions. The proposed methodological model enables students to develop context-appropriate, reflective, and communicative speaking skills through simplified AI tools. This approach enhances the quality of distance learning and fosters a new stage of digital pedagogy despite technical limitations.
Keywords: distance education, ESP, artificial intelligence, speaking skills, low internet bandwidth, methodological model, reflection, communicative competence.

Masofaviy ta'lim global miqyosda ta'lim tizimining ajralmas qismiga aylangan bir davrda, sun'iy intellekt texnologiyalari o'qitish jarayonini yanada interaktiv,

moslashuvchan va shaxsga yo‘naltirilgan qilish imkonini bermoqda. Ayniqsa, *English for Specific Purposes (ESP)* yo‘nalishida og‘zaki nutqni rivojlantirishda AI asosidagi multimodal vositalar (ChatGPT, Whisper, D-ID va boshqalar) talabalarga kontekstual muloqot, refleksiya va o‘zini baholash imkonini yaratmoqda. Biroq bu imkoniyatlar har doim ham barcha foydalanuvchilar uchun bir xil darajada ochiq emas. Ko‘plab hududlarda internet tezligining pastligi, texnik infratuzilmaning cheklanganligi hamda zamonaviy sun’iy intelekt platformalarining katta hajmdagi ma’lumot oqimini talab qilishi og‘zaki nutq mashqlarini to‘liq hajmda qo‘llashga to‘sqinlik qiladi. Natijada, ESP yo‘nalishidagi talabalar ko‘pincha og‘zaki nutqni rivojlantirish uchun real kontekstli va interaktiv muhitdan yetarli foydalana olmaydilar. Shu sababli, past internetli muhit uchun moslashtirilgan, kam resurs talab qiluvchi va pedagogik jihatdan asoslangan sun’iy intelekt metodikasini ishlab chiqish dolzarb masala hisoblanadi. Mazkur tadqiqot masofaviy ESP ta’limida past internet sharoitida ham ishlay oladigan soddalashtirilgan sun’iy intelekt vositalari yordamida og‘zaki nutq mashqlarini samarali tashkil etish imkoniyatlarini o‘rganadi.

Masofaviy ta’lim tizimining kengayib borishi ingliz tili, xususan, English for Specific Purposes (ESP) yo‘nalishida og‘zaki nutqni rivojlantirish jarayoniga yangi imkoniyatlar yaratdi. Sun’iy intellekt (AI) texnologiyalarining o‘qitish jarayoniga integratsiyasi talabalarda kontekstga mos muloqot qilish, professional terminologiyani to‘g‘ri qo‘llash va kommunikativ kompetensiyani oshirishga yordam bermoqda. Ayniqsa ChatGPT, Whisper, Speech Analyzer, D-ID kabi AI platformalari og‘zaki nutqni rivojlantirishda interaktiv, refleksiv va shaxsga yo‘naltirilgan imkoniyatlar taqdim etadi. Biroq O‘zbekiston va boshqa rivojlanayotgan davlatlarda internet tezligining pastligi hamda texnik imkoniyatlarning cheklanganligi ushbu imkoniyatlardan to‘liq foydalanishga to‘sqinlik qilmoqda. Natijada, talabalarning og‘zaki nutq mashqlarini to‘liq hajmda bajarish, audio-video muloqotda ishtirok etish yoki real vaqtli baholash tizimlaridan foydalanish imkoniyati kamayadi. Shu sababli past internetli muhit uchun moslashtirilgan, soddalashtirilgan va resurs jihatdan tejamkor AI yondashuvlarini ishlab chiqish zarurati yuzaga kelmoqda. Tadqiqot davomida masofaviy ESP ta’limida og‘zaki nutq mashqlarini AI asosida samarali tashkil etish uchun uch bosqichli metodik model ishlab chiqildi. Birinchi bosqich — tayyorlov bosqichi bo‘lib, unda talabalar offlayn rejimda mutaxassislikka oid situatsion matnlar va dialoglarni o‘rganadilar hamda AI tizimiga yuklaydilar. Bu jarayon minimal internet sarfi bilan amalga oshiriladi. Ikkinchi bosqich — interaktiv bosqichda ChatGPT yoki shunga o‘xshash platformalar orqali qisqa, lekin maqsadli dialoglar tashkil etiladi. AI tizimi talabalar nutqining grammatik to‘g‘riligi, talaffuz aniqligi va kontekstga mos javob berish darajasini baholaydi. Uchinchi bosqich — refleksiv

bosqichda AI talabalarga avtomatik fikr-mulohaza (feedback) beradi va ularni o‘z nutqini tahlil qilishga undaydi. Internet uzilishi holatlarida bu ma’lumotlar matnli shaklda saqlanib, keyinchalik ko‘rish uchun taqdim etiladi. Buning uchun *visual-light, audio-priority* va *text-driven* rejimlar uyg‘unlashtirildi. Bunda video kontent o‘rniga qisqa audio fayllardan, matnli chatbotlardan va soddalashtirilgan interfeyslardan foydalanildi. Bu yondashuv past internet tezligiga ega hududlarda ham og‘zaki nutqni rivojlantirish imkonini beradi. Talabalar AI yordamida muloqot jarayonida o‘z nutqidagi xatolarni aniqlash, ularni mustaqil tahlil qilish va kontekstga mos ifodalarni qo‘llashni o‘rganadilar.

Sun’iy intellekt texnologiyalarining oqilona integratsiyasi past internet sharoitida ham masofaviy ESP ta’limini yangi bosqichga olib chiqish imkonini beradi. Ishlab chiqilgan metodik model og‘zaki nutqni rivojlantirish jarayonida talabalarning kontekstga mos fikrlash, refleksiya va muloqot madaniyatini yuksaltirishda samarali vosita bo‘lib xizmat qildi. AI asosidagi yondashuv texnik cheklovlarni ijodiy imkoniyatga aylantirib, o‘quv jarayonini yanada moslashuvchan va shaxsga yo‘naltirilgan shaklga keltirdi. Bunday tizim pedagogik jarayonda innovatsion fikrlash, mustaqillik va kommunikativ madaniyatni rivojlantirishga xizmat qiladi. Ushbu yondashuv O‘zbekiston ta’lim tizimida raqamli pedagogikaning yangi istiqbollarini ochadi.

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TERMOELASTIKLIK NAZARIYASI MASALALARINING KUCHLANISHLARGA NISBATAN MODEL TENGLAMASI

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Annotatsiya. Termoelastiklik nazariyasi masalalarni odatda kuchlanishlarda yechishda Eri kuchlanish funksiyasi kiritib yechilgan lekin biz bu ishda hech qanday qo‘shimcha funksiya kiritmasdan to‘g‘ridan tog‘ri kuchlanishlarga nisbatan termoelastiklik nazariyasi masalasini fazoviy holatda qo‘yilishi va yechish algoritmi ko‘rsatib o‘tilgan.
Kalit so‘zlar. Beltrami-Mitchell tenglamalari, iteratsiya, kuchlanish, kuchlanish funksiyasi.

MODEL EQUATION OF THERMOELASTICITY THEORY PROBLEMS IN TERMS OF STRESS

Abstract. In the theory of thermoelasticity, problems are typically solved in terms of stress by introducing Airy’s stress functions. However, in this work, the problem of thermoelasticity is formulated and solved directly in terms of stresses in a spatial setting, without introducing any additional functions. The algorithm for the solution is also presented.
Keywords: Beltrami-Mitchell equations, iteration, stress, stress function.

Ko‘p hollarda konstruksiyalar va ularning elementlarining deformatsiyalanish jarayoni termomexanik kuchlar ta’sirida sodir bo‘lib, bu jarayon qattiq jismlarda issiqlik ajralishi hamda haroratning oshishi bilan kechadi. Issiqlik tarqalish jarayonini tasvirlovchi matematik modelni birinchi marta Dyugamel–Neyman ishlarida [4-7] ko‘rib chiqilgan bo‘lib, unda to‘liq deformatsiya elastik deformatsiya va termik kengayish deformatsiyasidan iborat deb hisoblangan. Deformatsiyalanadigan qattiq jismlarning termoelastiklik nazariyasi masalalari quyidagi ishlarda tadqiq etilgan [2-3]. Odatda, termoelastiklik masalalarini yechishda temperatura issiqlik o‘tkazuvchanlik tenglamasi yechimi sifatida ma’lum deb olinadi va haroratga bog‘liq bo‘ladi. Bunday masalalar bog‘lanmagan termoelastiklik masalalar deb ataladi. Odatda, deformatsiyaning birgalikda bo‘lish shartlari doirasida tekis termoelastiklik nazaraiyasi masalalari Dyugamel–Neyman munosabatlari yordamida Erining kuchlanish funksiyasi va haroratga nisbatan bigarmonik tenglamani yechishga

keltiriladi [6,8]. Bunda T funksiya (harorat maydoni) issiqlik oqimi tenglamasi yechimi sifatida ma'lum deb olinadi. Kuchlanishdagi fazoviy termoelastiklik nazariyasi masalalari Filonenko-Borodich tomonidan ko'rib chiqilgan [3].

Kuchlanishga nisbatan elastiklik nazariyasining chegaraviy masalalari yangi qo'yilishda quyidagi ishlarda ko'rib chiqilgan [2,4,5].Biz bu ishda temperaturani hisobga olgan holda BeltramiMitchell tenglamasi quyidagi ko'rinishda ifodalanadi:

$$\nabla^2\sigma_{ij}+\frac{1}{1+\nu}S_{,ij}=-\left(X_{i,j}+X_{i,j}\right)-\frac{\nu}{1-\nu}X_{k,k}\delta_{ij}-2\mu\alpha\left(T_{,ij}+\frac{1+\nu}{1-\nu}\delta_{ij}\nabla^2T\right). \qquad (1)$$

Bu yerda σ_{ij}-kuchlanish tenzori, $\nu=\lambda/\left(\lambda+\mu\right)/2$ -Puasson koeffitsiyenti, λ,μ-Lame parametrlari, X_i-hajmiy kuchlar, δ_{ij} - Kroneker simvoli, ∇^2 – Laplas operatori.

Agar yuqoridagi (1) tenglamada fazoviy masala sifatida qarasak va hajmiy kuchlar yo`q bo'lsa, u holda quyidagi ifoda keladi:

$$\frac{\partial^2\sigma_x}{\partial x^2}+\frac{\partial^2\sigma_x}{\partial y^2}+\frac{\partial^2\sigma_x}{\partial z^2}=2\mu\alpha\frac{1+\nu}{1-\nu}\left(\frac{\partial^2T}{\partial y^2}+\frac{\partial^2T}{\partial z^2}\right), \qquad (2)$$

$$\frac{\partial^2\sigma_y}{\partial x^2}+\frac{\partial^2\sigma_y}{\partial y^2}+\frac{\partial^2\sigma_y}{\partial z^2}=2\mu\alpha\frac{1+\nu}{1-\nu}\left(\frac{\partial^2T}{\partial x^2}+\frac{\partial^2T}{\partial z^2}\right), \qquad (3)$$

$$\frac{\partial^2\sigma_z}{\partial x^2}+\frac{\partial^2\sigma_z}{\partial y^2}+\frac{\partial^2\sigma_z}{\partial z^2}=2\mu\alpha\frac{1+\nu}{1-\nu}\left(\frac{\partial^2T}{\partial x^2}+\frac{\partial^2T}{\partial y^2}\right), \qquad (4)$$

$$\frac{\partial^2\sigma_{xy}}{\partial x^2}+\frac{\partial^2\sigma_{xy}}{\partial y^2}+\frac{\partial^2\sigma_{xy}}{\partial z^2}=2\mu\alpha\frac{1+\nu}{1-\nu}\frac{\partial^2T}{\partial x\partial y}, \qquad (5)$$

$$\frac{\partial^2\sigma_{xz}}{\partial x^2}+\frac{\partial^2\sigma_{xz}}{\partial y^2}+\frac{\partial^2\sigma_{xz}}{\partial z^2}=2\mu\alpha\frac{1+\nu}{1-\nu}\frac{\partial^2T}{\partial x\partial z}, \qquad (6)$$

$$\frac{\partial^2\sigma_{yz}}{\partial x^2}+\frac{\partial^2\sigma_{yz}}{\partial y^2}+\frac{\partial^2\sigma_{yz}}{\partial z^2}=2\mu\alpha\frac{1+\nu}{1-\nu}\frac{\partial^2T}{\partial y\partial z}. \qquad (7)$$

Bu (2-4)-tenglamalar uch o'lchovli holatda Beltrami-Mitchell tenglamalarida temperaturani hisobga olingan holdagi tenglamalari.Chegaraviy shartlar esa quyidagicha

$$\sigma_{ij,j}\big|_{\sum}=S_i, \qquad (8)$$

(2-8) tengalamalar termoelastiklik nazariyasi masalasining klassik holatda qo‘yilishini ifodalaydi. Lekin yuqoridagi tenglamalarda chegaraviy shart yetarli bo‘lmaganligi uchun biz prof. Pobedrya tomonidan ishlarida taklif qilingan shartni olamiz. Ya’ni u shart quyidagicha ifodalanadi „Muvozanat tenglamasi soha ichida bajarilsa biz soha chegarasida ham muvozanat tengalamasini ishlatsak bo‘ladi“. Demak biz muvozanat tengalamasini chegaraviy shart sifatida soha chegarasidako‘ramiz:

$$\sigma_{ij,j}\big|_{\sum} = 0, \qquad (9)$$

(2-9) tenglamalar termoelastiklik nazariyasining fazoviy masalasini kuchlanishlarga nisbatan qo‘yilishini ifodalaydi. Bu tenglamalarni chekli ayirmali ko‘rinishga o‘tkazib iteratiya usulida yechamiz.

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CURRENT STAGE OF DIPLOMATIC RELATIONS BETWEEN TURKEY AND UZBEKISTAN

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ABSTRACT

This article provides a scholarly analysis of the content, driving factors, and institutional characteristics of diplomatic relations between Turkey and Uzbekistan at the current stage. The study highlights the intensification of political dialogue between the two states, the formation of a strategic partnership, and the strengthening of diplomatic trust mechanisms as key outcomes. Particular attention is paid to the role of cultural-humanitarian and public diplomacy, as well as the significance of cooperation within international and regional organizations. Based on contemporary theories of international relations, the article formulates conclusions and identifies the future prospects of Turkey–Uzbekistan diplomatic relations.

Keywords: Turkey–Uzbekistan relations, diplomatic cooperation, strategic partnership, foreign policy, diplomatic trust, institutional diplomacy, regional stability, Organization of Turkic States, international cooperation, cultural-humanitarian diplomacy, public diplomacy, political dialogue, modern diplomacy

Introduction. In the second quarter of the twenty-first century, the system of international relations is undergoing profound transformation. Changes in the global balance of political power, the acceleration of regional integration processes, and the emergence of new forms of diplomatic engagement require a reconsideration of interstate relations. In such a complex and multidimensional geopolitical environment, diplomatic relations between Turkey and Uzbekistan have gained particular scholarly and practical significance. Relations between the two countries are based not only on historical and cultural commonalities but also on the convergence of contemporary political interests.

From the first years of its independence, Uzbekistan entered history as one of the initial states to establish diplomatic relations with Turkey. While these relations were initially shaped primarily by political and cultural proximity, at the current stage they have evolved to the level of a strategic partnership. In recent years, the intensification of

political dialogue between the leaders of the two countries, the regularity of high-level visits, and mutual support in international arenas indicate a qualitative transition of diplomatic relations to a new stage [1].

In this process, diplomatic relations between Turkey and Uzbekistan are not limited to bilateral interests alone but also play a significant role within a broader regional and civilizational context. In particular, cooperation conducted within the framework of the Organization of Turkic States provides additional institutional foundations for these relations and contributes to the formation of a pan-Turkic political identity and cooperation model.

In our view, the current stage of Turkey–Uzbekistan diplomatic relations differs fundamentally from previous periods. Whereas relations in the early years were more symbolic and cautious in nature, today they are pragmatic, systematic, and oriented toward long-term strategic objectives. In particular, Uzbekistan's open foreign policy concept has created a favorable political environment for strengthening relations with Turkey. This situation clearly reflects a modern diplomatic model based on trust, balance of interests, and institutional cooperation.

Furthermore, diplomatic relations at the current stage are increasingly deepening through cultural-humanitarian, educational, and public diplomacy. The historical, religious, and linguistic commonalities between the two nations strengthen the social foundation of diplomatic relations. Through "soft power" mechanisms, these factors positively influence political dialogue and serve as an important complement to official diplomacy [2].

Moreover, Turkey–Uzbekistan diplomatic relations are also significant from the perspective of pursuing a balanced foreign policy under conditions of global geopolitical competition. Both states conduct foreign policies based on the principles of sovereignty, mutual respect, and non-interference in internal affairs, viewing diplomatic dialogue as a key factor of stability and development.

In our assessment, diplomatic relations between Turkey and Uzbekistan extend beyond the interests of the two states alone and contribute to the formation of a new culture of political dialogue in Central Asia. The growing priority of diplomatic trust and the strengthening of approaches based on cooperation and consensus rather than power politics represent valuable experience for contemporary international relations. This model may serve as an example for other regional cooperation formats in the future.

From this perspective, the primary objective of the present study is to conduct a scholarly analysis of the essence, development factors, and prospects of diplomatic relations between Turkey and Uzbekistan at the current stage. The findings of the study

allow for important conclusions not only in theoretical terms but also for practical diplomacy.

Methods. This study is aimed at a comprehensive and systematic examination of the current stage of diplomatic relations between Turkey and Uzbekistan and employs methodological approaches drawn from contemporary political science, international relations, and diplomatic theory. Taking into account the multifaceted nature of the topic, the research methodology is based on the integration of theoretical and empirical analytical methods. This approach enables the interpretation of bilateral diplomatic relations not merely as a set of facts, but as a dynamic political process.

First and foremost, the historical-analytical method was applied. This method made it possible to systematically examine the formation, gradual development, and current state of diplomatic relations between Turkey and Uzbekistan. In particular, the early post-independence period, phases of stagnation, and periods of renewed engagement were analyzed in historical sequence. This approach helped identify the historical roots of the current phase of diplomatic rapprochement [3].

In the author's view, the historical-analytical method is of particular importance in this study, as diplomatic relations never emerge in a "vacuum." A proper understanding of today's strategic closeness between Turkey and Uzbekistan requires in-depth analysis of past crises of political trust, regional factors, and domestic political transformations. The historical method allows for the identification of both continuity and rupture within diplomatic relations.

In addition, the comparative method was widely employed. Through this approach, Turkey–Uzbekistan diplomatic relations were compared with other bilateral relationships, including Turkey's relations with other Central Asian states and Uzbekistan's diplomatic ties with its other strategic partners. Comparative analysis helped identify both the distinctive features and general trends of diplomatic relations [4].

According to the above considerations, the comparative method serves as an important tool for revealing the unique characteristics of Turkey–Uzbekistan relations. This diplomatic model is based not only on economic or political interests but also on civilizational proximity and cultural identity. Comparison with other bilateral relations further clarifies the soft power–based dimensions of these ties.

A key component of the research methodology was the use of systemic and structural analysis. This method enabled the examination of Turkey–Uzbekistan diplomatic relations as an integral element of a broader political system. Diplomatic dialogue, high-level visits, intergovernmental commissions, parliamentary relations, and public diplomacy were analyzed as interrelated components of a single system [5].

In our view, it is impossible to fully comprehend contemporary diplomatic processes without a systemic approach. Modern diplomacy is no longer limited to the activities of foreign ministries alone; various institutions, non-state actors, and cultural mechanisms operate as a unified system. Turkey–Uzbekistan relations exemplify such a multi-layered structure, making it scientifically justified to study them as interconnected rather than isolated phenomena.

Furthermore, the study employed the method of normative-legal document analysis. This method was used to analyze bilateral treaties, joint declarations, strategic partnership agreements, and documents adopted within the framework of international organizations. The normative-legal basis made it possible to define the formal and institutional boundaries of diplomatic relations [6].

From our perspective, normative-legal documents constitute the “official map” of diplomatic relations. However, they should be interpreted not merely as legal texts but as expressions of political will. The documents signed between Turkey and Uzbekistan in recent years reflect the parties’ long-term strategic objectives and indicate the strengthening of diplomatic trust.

Overall, the methodological approaches applied in this study made it possible to analyze diplomatic relations between Turkey and Uzbekistan as a multi-level, dynamic, and complex political process. The integration of these methods contributed to the scientific reliability and theoretical soundness of the research findings.

Results. The findings of this study demonstrate that, at the current stage, diplomatic relations between Turkey and Uzbekistan have risen to a qualitatively new level, moving beyond the framework of traditional bilateral relations and acquiring a multi-layered and strategic character. The institutionalization of diplomatic cooperation, the regularity of political dialogue, and coordinated positions in the international arena emerge as the principal outcomes of this process.

First of all, the research results indicate a strengthening of political and diplomatic trust between the two states. The increase in the number of high-level mutual visits, the signing of strategic partnership agreements, and regular political consultations contribute to the stability of diplomatic relations. This situation confirms that trust has become a key form of capital in interstate relations [7].

In our view, the consolidation of diplomatic trust represents the most significant achievement of Turkey–Uzbekistan relations. In the contemporary system of international relations, a lack of trust often leads to the failure of many cooperative initiatives. In contrast, dialogue between these two states is characterized by consistency between official statements and practical actions, which enhances the real effectiveness of diplomacy.

The second major outcome is the intensification of institutional diplomacy. The study reveals that intergovernmental commissions, strategic consultation mechanisms between foreign ministries, and inter-parliamentary friendship groups have become core institutions ensuring the continuity of diplomatic relations. These institutions shift diplomatic cooperation away from personal ties toward a systematic and long-term foundation [8].

From our perspective, the strengthening of institutional mechanisms is precisely what stabilizes relations between Turkey and Uzbekistan. Even in conditions of political leadership change, institutions preserve continuity in diplomatic orientations. This reduces the personalization of relations and elevates them to the level of state policy.

The third outcome identified is the expansion of cooperation within international and regional organizations. The research shows that Turkey and Uzbekistan promote coordinated positions within the United Nations, the Organization of Islamic Cooperation, the Economic Cooperation Organization, and the Organization of Turkic States. This indicates the growing alignment of the two countries' diplomacy at both global and regional levels [9].

In our opinion, cooperation within international organizations elevates Turkey–Uzbekistan relations from a purely bilateral format to the level of multilateral diplomacy. In particular, cooperation within the Organization of Turkic States contributes to the formation of a shared political identity, which represents an important practical manifestation of civilizational proximity in modern diplomacy.

The fourth significant result is the strengthening of cultural-humanitarian and public diplomacy. The study demonstrates that cooperation in education, science, culture, and tourism is reinforcing the social foundations of diplomatic relations. Student exchanges, joint cultural events, and academic forums have become important factors complementing official diplomacy [10].

In our view, cultural-humanitarian diplomacy constitutes the most stable layer of relations between Turkey and Uzbekistan. While political circumstances may change, cultural closeness between peoples tends to be long-lasting. This factor ensures the social legitimacy of diplomatic relations and provides them with a solid foundation.

The fifth outcome is the establishment of a strong basis for the future prospects of diplomatic relations. The study indicates that the current model of diplomatic cooperation between Turkey and Uzbekistan aligns with long-term strategic planning. Digital diplomacy, economic diplomacy, and dialogue in the field of security create opportunities for further deepening relations in the future [11].

From this perspective, Turkey–Uzbekistan diplomatic relations may serve as an important model for regional stability and development. In these relations, approaches

based on consensus and balance of interests prevail over power politics, which should be regarded as one of the core principles of contemporary diplomacy.

Discussion. The analysis of the research findings demonstrates that, at the current stage, diplomatic relations between Turkey and Uzbekistan are not limited to practical cooperation alone but also possess profound theoretical and conceptual significance. These relations represent an important empirical model illustrating how strategic partnerships between states are formed and consolidated in the contemporary system of international relations. In particular, a diplomatic approach based on sovereignty, mutual respect, and balance of interests constitutes the main theoretical strength of these ties.

First, interpreting Turkey–Uzbekistan diplomatic relations through the lens of modern international relations theories reveals their constructive nature. The findings show that the core ideas of constructivist theory—identity, historical memory, and shared values influencing diplomatic processes—are clearly manifested in these relations [12].

In our view, diplomatic closeness between Turkey and Uzbekistan cannot be explained solely by realpolitik or economic interests. Pan-Turkic identity, historical memory, and cultural proximity function as key constructive factors. These aspects distinguish these relations from many other bilateral ties and contribute to their relative stability.

Second, the discussion reveals that elevating diplomatic trust to an institutional level is one of the main factors ensuring the long-term stability of these relations. Strategic partnership documents, joint declarations, and permanent consultation mechanisms have transformed trust from a personal level into a dimension of state policy [13].

In our assessment, the institutionalization of trust is of decisive importance in contemporary diplomacy. The experience of Turkey and Uzbekistan demonstrates that trust cannot be sustainable if it relies solely on personal relations between political leaders. Institutional mechanisms transform trust into a systematic and renewable resource.

Third, the findings indicate the need to reassess the role of Turkey–Uzbekistan relations within the context of regional diplomacy. These ties contribute to the formation of a new diplomatic culture in Central Asia based on open dialogue, consensus, and cooperation. In particular, Turkey’s soft power strategy toward Central Asia and Uzbekistan’s open foreign policy mutually reinforce each other [14].

In our view, Turkey–Uzbekistan relations offer a diplomatic model based on balanced cooperation rather than power competition in Central Asia. This model not only strengthens regional stability but also provides valuable diplomatic experience for small and medium-sized states.

Fourth, the discussion shows that cultural-humanitarian diplomacy is no longer a secondary element of political dialogue but has become an independent and strategic factor. Cooperation in education, science, and culture serves as a “social buffer” that reduces the likelihood of political disagreements [15].

In our assessment, cultural-humanitarian diplomacy is often underestimated. However, it constitutes the most stable layer of interstate relations. The Turkey–Uzbekistan case demonstrates how this process fosters long-term trust and mutual understanding between peoples.

Fifth, the discussion also addresses future prospects and potential risks. Global geopolitical competition, economic instability, and regional security challenges may indirectly affect these relations. Nevertheless, existing diplomatic mechanisms provide tools for managing such risks [16].

In our view, the key strength of Turkey–Uzbekistan diplomatic relations lies in their adaptability. The parties respond to global and regional changes pragmatically and in a balanced manner, without rigid bloc alignment. This protects the relations from short-term political fluctuations.

Overall, the discussion results indicate that diplomatic relations between Turkey and Uzbekistan offer important scholarly insights for both the theory and practice of international relations. This model clearly demonstrates the interconnection between trust, identity, and institutional stability in diplomacy and provides a solid theoretical foundation for future research.

Conclusion. The findings of this study provide scholarly evidence that, at the current stage, diplomatic relations between Turkey and Uzbekistan have acquired a stable, systematic, and strategic character. The empirical and theoretical conclusions demonstrate that relations between the two states are developing not only within the framework of traditional bilateral diplomacy but also in close interaction with regional and global political processes. This confirms the priority of mutual trust, balance of interests, and long-term strategic planning in the foreign policies of both Turkey and Uzbekistan.

The study shows that the current stage of diplomatic relations differs qualitatively from previous periods. Whereas earlier relations were more symbolic and cautious in nature, today they are reinforced through concrete institutional mechanisms, strategic agreements, and regular political dialogue. High-level visits, intergovernmental commissions, and parliamentary cooperation have become key factors ensuring the continuity of diplomatic relations.

Furthermore, the findings highlight the importance of emphasizing the role of cultural-humanitarian and public diplomacy. Historical, cultural, and linguistic commonalities

between the two peoples provide a strong social foundation for diplomatic relations. This factor strengthens the atmosphere of trust in political dialogue and enhances the stability of diplomatic ties. As a result, official diplomacy and soft power mechanisms operate in a complementary and mutually reinforcing manner.

Another important conclusion is that diplomatic relations between Turkey and Uzbekistan contribute to strengthening regional stability and cooperation. These ties foster the formation of a diplomatic culture in Central Asia based on open dialogue, mutual respect, and consensus. This represents a significant example of balanced and pragmatic foreign policy conduct in the contemporary system of international relations.

In conclusion, the current model of diplomatic relations between Turkey and Uzbekistan is of substantial scholarly and practical importance. It clearly demonstrates the interdependence of trust, institutional stability, and strategic cooperation in interstate relations. The findings of this study may serve as a theoretical basis for further academic research and may also be utilized in the formulation of effective decisions in the field of practical diplomacy.

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DIGITAL TRANSFORMATION IN EDUCATION SYSTEMS

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Abstract
Digital transformation is fundamentally changing education systems around the world by integrating advanced information technologies into teaching, learning, and administration. This article explores the adoption of digital tools, cloud computing, artificial intelligence, and online learning platforms in modern education. It examines how these technologies improve accessibility, engagement, personalization, and operational efficiency. The study also considers the challenges associated with infrastructure, digital literacy, data security, and equity. Overall, the implementation of digital solutions enhances student learning outcomes, supports institutional management, and prepares educational institutions for the evolving demands of the digital era.

Keywords: digital transformation, education systems, e-learning, cloud computing, artificial intelligence, online education, educational technology, digital tools.

Digital transformation in education has become an essential strategy for institutions aiming to improve learning outcomes and adapt to the demands of the twenty-first century. The rapid development of information and communication technologies has shifted education from traditional classroom-based instruction to a more flexible, technology-driven model. E-learning platforms such as Moodle, Canvas, and Google Classroom allow teachers to deliver content, assignments, and assessments online, providing students with the opportunity to learn at their own pace and from any location. These platforms support interactive learning, collaboration, and immediate feedback, which enhances student engagement and motivation. The integration of cloud computing further strengthens digital education by offering scalable storage, resource sharing, and virtual classroom capabilities. Educational institutions no longer need to maintain extensive physical infrastructure, as cloud solutions allow centralized management of learning materials and administrative data.

Artificial intelligence plays a significant role in modern educational systems by personalizing the learning experience and optimizing teaching strategies. AI-powered tools analyze student performance, adapt content to individual needs, provide intelligent tutoring, and automate grading. These technologies enable educators to focus on critical thinking, problem-solving, and creative instruction while ensuring that

each student receives a tailored learning experience. Data analytics complement these processes by tracking progress, identifying gaps in knowledge, and providing actionable insights for decision-making. By leveraging data-driven approaches, institutions can improve curriculum design, resource allocation, and overall educational quality.

Digital transformation also promotes accessibility and equity in education. Students from different regions, socioeconomic backgrounds, and physical abilities can access quality educational resources online, reducing barriers to learning. Virtual and augmented reality technologies offer immersive experiences that make complex concepts more comprehensible, while interactive simulations allow practical skills development in a safe environment. Furthermore, the COVID-19 pandemic demonstrated the necessity of digital education infrastructure, as many institutions had to rapidly transition to online learning to maintain continuity in teaching and learning processes.

Despite the numerous advantages, the digital transformation of education comes with challenges that require careful attention. Reliable internet access, sufficient hardware, and technical support are fundamental prerequisites for effective online learning. Both educators and students must develop digital literacy to navigate and utilize educational technologies efficiently. Additionally, protecting student data and institutional information from cyber threats is a critical concern that necessitates robust security measures. Resistance to change and unequal access to digital resources may also create disparities in learning outcomes, making it essential for policymakers and educators to implement inclusive strategies and provide appropriate training and support.

In Uzbekistan, digital transformation is increasingly recognized as a priority for the education sector. Government initiatives, including the “Digital Uzbekistan – 2030” strategy, promote the adoption of cloud-based platforms, e-learning systems, and AI tools across public and private institutions. These measures aim to modernize educational infrastructure, enhance the quality of teaching, and prepare students for the demands of the digital economy.

In conclusion, digital transformation is redefining education systems by integrating innovative technologies into teaching, learning, and administration. The combined use of e-learning platforms, cloud computing, artificial intelligence, data analytics, and immersive technologies creates more accessible, engaging, and personalized learning environments. While challenges such as infrastructure limitations, digital literacy, and data security persist, strategic implementation of digital solutions can significantly improve the quality and efficiency of education. Institutions that embrace digital

transformation are better equipped to meet contemporary educational demands and to prepare students for future success in an increasingly digital and interconnected world.

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