



HS

KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT

RESPUBLIKA ILMIIY-AMALIY
MASOFAVIY KONFERENSIYASI



zenodo



innopublication.com



“KELAJAK TEXNOLOGIYALARI VA SUN’IY INTELLEKT”
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

Ushbu to’plamda **“KELAJAK TEXNOLOGIYALARI VA SUN’IY INTELLEKT”** nomli respublika ilmiy-amaliy masofaviy konferensiyasining 2026-yil 4-soniga qabul qilingan maqolalar nashr etilgan.

“Kelajak texnologiyalari va sun’iy intellekt” nomli respublika ilmiy-amaliy masofaviy konferensiyasi zamonaviy axborot texnologiyalari, sun’iy intellekt, raqamli transformatsiya va innovatsion yechimlar sohasidagi ilmiy tadqiqotlarni qo’llab-quvvatlashga qaratilgan. Konferensiya materiallari tegishli soha mutaxassislari tomonidan ko’rib chiqilgan original ilmiy maqolalar va tezislardan iborat bo’lib, unda professor-o’qituvchilar, doktorantlar, magistrantlar, iqtidorli talabalar, IT sohasi vakillari hamda mustaqil tadqiqotchilar ishtirok etishlari mumkin.

Konferensiya har oyda bir marotaba tashkil etilib, barcha ishtirokchilarga **sertifikat, maqola pdfi, DOI raqami** hamda **konferensiya to’plami** taqdim etiladi.

“INNOVATIVE PUBLICATION”- ILMIY TADQIQOTLARNI
QO’LLAB-QUVVATLASH MARKAZI

ILMIY-ONLAYN KONFERENSIYA TO’PLAMI
СБОРНИК НАУЧНЫХ-ОНЛАЙН КОНФЕРЕНЦИЙ
SCIENTIFIC-ONLINE CONFERENCE COLLECTION

<http://innopublication.com>





METHODOLOGICAL FOUNDATIONS FOR ORGANIZING ROBOTICS CLASSES IN PRESCHOOL EDUCATIONAL INSTITUTIONS

Axmedova Gulrux Rustam qizi

Second-Year Student, Faculty of Preschool and Primary Education, Nukus State
Pedagogical Institute named after Ajiniyaz

Abstract

This article examines the scientific and methodological foundations of organizing innovative robotics and elementary engineering classes in the modern preschool education system.

Keywords

preschool education, robotics, STEAM approach, divergent thinking, cognitive development, elementary modeling, algorithmic literacy, interactive environment.

MAKTABGACHA TA'LIM TASHKILOTLARIDA ROBOTOTEXNIKA MASHG'ULOTLARINI TASHKIL ETISHNING METODIK ASOSLARI

Axmedova Gulrux Rustam qizi

Ajiniyoz nomidagi Nukus davlat pedagogika instituti

Maktabgacha va boshlang'ich ta'lim fakulteti 2-kurs talabasi

Annotatsiya. Ushbu maqolada zamonaviy maktabgacha ta'lim tizimida innovatsion texnologiyalar, xususan, robototexnika va elementar muhandislik mashg'ulotlarini tashkil etishning ilmiy-metodik asoslari tadqiq qilingan.

Tayanch so'zlar: maktabgacha ta'lim, robototexnika, STEAM yondashuv, divergent tafakkur, kognitiv rivojlanish, elementar modellashtirish, algoritmik savodxonlik, interaktiv muhit.



"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

Аннотация. В данной статье исследуются научно-методические основы организации инновационных занятий по робототехнике и элементарному конструированию в современной системе дошкольного образования.

Ключевые слова: дошкольное образование, робототехника, STEAM-подход, дивергентное мышление, когнитивное развитие, элементарное моделирование, алгоритмическая грамотность, интерактивная среда.

Kirish. XXI asr - yuqori texnologiyalar va global raqamlashtirish davri. Bugungi kunda jamiyatning barcha sohalarida bo'lgani kabi, ta'lim tizimida ham tub islohotlar amalga oshirilmoqda. Axborot oqimi shiddat bilan o'sayotgan bir davrda maktabgacha ta'lim tashkilotlari (MTT) oldiga faqatgina bolalarga tayyor bilimlarni berish emas, balki ularda mustaqil fikrlash, tahlil qilish, muammoli vaziyatlardan chiqish va ijodiy yondashuv (kreativlik) ko'nikmalarini erta yoshdan shakllantirish vazifasi qo'yilmoqda.

Maktabgacha yoshdagi bolalik davri inson shaxsiyatining poydevori qo'yiladigan, kognitiv jarayonlar eng jadal rivojlanadigan bosqich hisoblanadi. Psixologik va pedagogik tadqiqotlar shuni ko'rsatadiki, bu yoshdagi bolalarning fikrlashi asosan ko'rgazmali-obrazli va ko'rgazmali-harakatli xarakterga ega. Ya'ni, bola tashqi olamni shunchaki eshitish orqali emas, balki narsalarni ushlab ko'rish, ularni qismlarga ajratish va qayta yig'ish, ya'ni amaliy faoliyat orqali mukammal anglaydi. Shu nuqtai nazardan, MTT tizimiga elementar muhandislik va robototexnika elementlarini joriy etish zamonaviy innovatsion pedagogikaning eng samarali vositalaridan biriga aylandi. Robototexnika mashg'ulotlari bolalarni quruq yodlashdan qutqarib, ta'limni jonli va qiziqarli kashfiyotlar jarayoniga aylantirish imkonini beradi.

Robototexnika mashg'ulotlarining pedagogik imkoniyatlarini tushunish uchun avvalo bolalar psixologiyasi va tafakkur rivojlanishi qonuniyatlariga murojaat qilish lozim. Mashhur psixolog Jan Piaje o'zining kognitiv rivojlanish nazariyasida





"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

maktabgacha yoshdagi bolalarni "operatsiyagacha bo'lgan davr" (preoperational stage) vakillari deb ataydi. Bu davrda bolalar ramziy fikrlashni boshlasalar-da, ularning mantiqiy operatsiyalarni bajarish qobiliyati hali to'liq shakllanmagan bo'ladi. Lev Vigotskiy esa bolaning rivojlanishida "yaqin rivojlanish zonasi" (zone of proximal development) tushunchasini kiritib, bolaning kattalar yordamida va maxsus tashkil etilgan muhitda o'z imkoniyatlaridan ancha yuqori natijalarga erisha olishini isbotlagan.

Robototexnika aynan mana shu ikki nazariyaning amaliy sintezidir. Konstruktor detallari bilan ishlash, muayyan mexanizmlarni yaratish jarayonida bolada mavhum tushunchalar (fazoviy o'lcham, muvozanat, og'irlik markazi, simmetriya) aniq shaklga kiradi. Bola harakat qilayotgan obyektidagi sabab-oqibat bog'lanishlarini o'z ko'zi bilan ko'radi. Masalan, agar u tishli g'ildirakni (shesternya) noto'g'ri joylashtirsa, robot harakatlanmaydi. Bu esa bolaga xatosini darhol anglash va uni tuzatish uchun mantiqiy tahlil qilish imkonini beradi. Natijada bolada faqatgina mexanik xotira emas, balki chuqur analitik va sintetik tafakkur rivojlanadi.

Zamonaviy ta'lim standartlarida STEAM (Science, Technology, Engineering, Arts, Mathematics) yondashuvi yetakchi o'rin tutadi. Robototexnika ushbu besh komponentni o'zida mujassam etgan mukammal fanlararo ko'prikdir. Mashg'ulotlar jarayonida ta'lim yo'nalishlari quyidagicha integratsiyalashadi:

-Matematika: Bolalar detallarni shakli, o'lchami va rangi bo'yicha guruhlaydilar, simmetriya qoidalariga rioya qiladilar, modelning o'ng va chap tomonlarini mutanosiblashtiradilar, robot yo'lini aniqlashda qadamlarni (masofani) sanaydilar.

-Muhandislik va Texnologiya: O'qlar, g'ildiraklar, richaglar va bloklar kabi oddiy mexanizmlarning ishlash prinsiplarini o'rganadilar. Maxsus dasturlar yordamida robotga buyruq berish orqali ilk algoritmik savodxonlikni egallaydilar.



"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

-San'at va Ijodkorlik: Har bir bola o'zi yaratgan robot dizayniga individual yondashadi. Uni estetik jihatdan bezatadi, ranglar kombinatsiyasini tanlaydi, modelga obraz va xarakter beradi.

-Nutq va Muloqot: Bola o'z loyihasini himoya qiladi, uning nima vazifa bajarishini so'zlab beradi. Bu esa bolaning lug'at boyligini oshiradi, monologik nutqini va o'z fikrini dadil bayon etish ko'nikmalarini yuzaga chiqaradi.

Yosh guruhlari bo'yicha robototexnikani tashkil etish metodikasi. MTTda robototexnika mashg'ulotlari bolalarning yosh va psixofiziologik xususiyatlaridan kelib chiqqan holda, qat'iy izchillik bilan tashkil etilishi lozim. Metodika quyidagi yosh guruhlarga bo'linadi:

1. Kichik va o'rta guruhlar (3-4, 4-5 yosh) - Sensor va motorika rivojlanishi. Bu davrda asosiy e'tibor bolaning qo'l mayda motorikasini rivojlantirishga qaratiladi. Bu yoshdagi bolalarga yirik hajmli, o'zaro oson birikadigan konstruktorlar (masalan, LEGO) beriladi. Mashg'ulotlar o'yin tarzida olib boriladi. Bolalar ranglar, geometrik shakllar, buyumlarning balandligi va kengligini farqlashni o'rganadilar. Metodik vazifa - bolada detalni detallarga qo'shish orqali butun bir obyekt (uy, minora, daraxt, hayvon shakli) yaratish ko'nikmasini hosil qilishdir.

2. Katta guruh (5-6 yosh) - Elementar muhandislik poydevori. 5-6 yoshli bolalarda fazoviy tasavvur sezilarli darajada kengayadi. Ushbu bosqichda mashg'ulotlarga oddiy mexanizmlar unsurlari kiritiladi. Bolalar tishli g'ildiraklarning bir-birini aylantirishi, o'qlarning vazifasi bilan tanishadilar. Bolalar maxsus tayyorlangan tematik gilamchalar ustida robot "asalari"ni kerakli manzilga (masalan, gul oldiga yoki uyiga) olib borish uchun uning ustidagi tugmachalarni bosib, oddiy chiziqli algoritmlar tuzadilar.

3. Maktabga tayyorlov guruhi (6-7 yosh) - Ilmiy-amaliy robototexnika. Bu guruhda mashg'ulotlar yanada tizimli va ilmiy xarakterga ega bo'ladi. Bolalar sensorlar



“KELAJAK TEKNOLOGIYALARI VA SUN’IY INTELLEKT”
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

(masofani o‘lchash, rangni aniqlash sensorlari) va motorlar bilan ishlaydigan robototexnika to‘plamlari (LEGO Education) bilan ishlay boshlaydilar.

Mashg‘ulotlarni tashkil etishning innovatsion pedagogik texnologiyalari. Robototexnika mashg‘ulotlari an’anaviy ta’lim uslubidagi “tarbiyachi ko‘rsatadi - bola takrorlaydi” sxemasidan mutlaqo farq qilishi kerak. Aks holda mashg‘ulot o‘zining ijodiy qiymatini yoqotadi. Zamonaviy metodikada quyidagi interaktiv texnologiyalardan foydalanish tavsiya etiladi:

Muammoli-izlanuvchan metod: Tarbiyachi mashg‘ulot boshida muammoni o‘rtaga tashlaydi. Masalan: “Bolalar, bizning robotimiz loydan o‘ta olmayapti, uning g‘ildiraklarini qanday o‘zgartirsak, u loyga botib qolmaydi?”. Bolalar o‘zlari mustaqil ravishda yechimlar qidiradilar, kengroq shinalar yoki g‘ildirak o‘rniga gusenitsalar qo‘yib ko‘radilar.

Loyiha metodi (Project-based learning): Bolalar kichik jamoalarga (2-3 kishidan) bo‘linib, uzoqroq muddatli bitta umumiy loyiha ustida ishlaydilar. Masalan, “Kelajak ekologik shahri” yoki “Kosmik stansiya”. Har bir guruh o‘zining maxsus binosi yoki robotini yasaydi va oxirida loyihalar birlashtiriladi. Bu metod jamoada ishlash va hamkorlik (collaborative) kompetensiyalarini yuksaltiradi.

Divergent topshiriqlar tizimi: Bolalarga yagona to‘g‘ri yechimi bo‘lmagan vazifalar beriladi. Masalan, “Shunday o‘yinchoq yasangki, u yuk tashiydigan bo‘lsin”. Bolalarning har biri o‘z tasavvuridagi mutlaqo turlicha bo‘lgan transport vositalarini kashf qiladilar. Bu jarayon bolani qoliplardan chiqishga o‘rgatadi.

Xulosa o‘rnida ta’kidlash lozimki, maktabgacha ta’lim tashkilotlarida robototexnika mashg‘ulotlarini tizimli va metodik jihatdan to‘g‘ri yo‘lga qo‘yish - kelajak jamiyati uchun yuqori intellektual salohiyatga ega, kreativ va tanqidiy fikrlaydigan avlodni tarbiyalashning muhim kafolatidir. Robototexnika shunchaki zamonaviy trend yoki o‘yin emas, balki bolaning yashirin kognitiv imkoniyatlarini



“KELAJAK TEKNOLOGIYALARI VA SUN’IY INTELLEKT”
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

yuzaga chiqaruvchi kuchli pedagogik platformadir. Ushbu yo‘nalishning samaradorligini yanada oshirish uchun MTTlarni zamonaviy moddiy-texnik bazalar (konstruktor to‘plamlari, raqamli vositalar) bilan ta‘minlash, tarbiyachilarning STEAM va robototexnika sohasidagi metodik malakalarini doimiy ravishda oshirib borish hamda milliy ta‘lim xususiyatlarini hisobga olgan metodik qo‘llanmalarni ko‘paytirish davlat miqyosidagi dolzarb pedagogik vazifalardan biri bo‘lib qolishi zarur.

Foydalangan adabiyotlar ro‘yxati:

1. O‘zbekiston Respublikasining “Maktabgacha ta‘lim va tarbiya to‘g‘risida”gi Qonuni. Toshkent, 2019.
2. “Ilk qadam” davlat o‘quv dasturi. Toshkent, 2022.
3. Papert, S. Mindstorms: Children, Computers, and Powerful Ideas. New York: Basic Books. 1980.
4. Выготский Л.С. Воображение и творчество в детском возрасте. М.: Просвещение, 1991. - 93 с.: ил./ Психол. очерк: Кн. для учителя. – 3-е изд. – ISBN 5-09-003428-1
5. Ж.Пиаже. Речь и мышление ребенка / Пиаже Жан; [перевод с французского]. Москва: Издательство АСТ, 2020. -. 352 с.
6. Sullivan A., Bers M. U. Robotics in the early childhood classroom: Learning outcomes from an 8-week curriculum. // Journal of Technology Education, Vol. 27, No. 1, 2016. – Pp. 18-35.





TWO-ENERGY X-RAY ABSORBSIOMETRY RESULTS IN PATIENTS WITH TYPE 2 DIABETES WITH SARCOPENIA

Yusupova Shakhnoza Kadirzhanovna

Andijan State Medical Institute, UZ Doctor of Medical Sciences, Professor, Head
of the Department of Hospital Therapy and Endocrinology

Izatillaev Azizbek Avazbek o'g'li

Doctor "A" Private Clinic

Abstract

Today, type 2 diabetes mellitus (T2DM) and sarcopenia (SA) are becoming increasingly common diseases. The question of whether the onset of type 2 diabetes increases the risk of developing CA or vice versa has long been under study. Both conditions are associated with negative changes in the state of skeletal muscles, which in turn can lead to impaired physical function, decreased quality of life, and increased mortality risk. Improper nutrition can exacerbate both type 2 diabetes and SA. T2DM and SA are linked by a vicious circle of events that intensify and worsen each other. Muscle insulin resistance appears to be a pathophysiological link between type 2 diabetes and CA. [1].

For over ten years, researchers have noted the overlap between the metabolic states of SA and type 2 diabetes mellitus (DM2) [1-3]. This coincidence is observed in adults of all ages, but is increasingly occurring in older adults [4-6]. CA is defined as exhaustion or loss of muscle tissue; ASM occurs when there is an imbalance between the synthesis and decomposition of muscle proteins [7]. Type 2 diabetes is a common metabolic disorder characterized by changes in carbohydrate metabolism resulting from decreased insulin sensitivity in target tissues along with a relative deficiency in insulin secretion. Type 2 diabetes is also characterized by disorders in protein and lipid metabolism [8, 9].





"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

A wide range of causes contributes to the overlap of type 2 diabetes and SA and the associated adverse consequences. These include malnutrition (excessive and insufficient nutrition, especially caused by the presence of other chronic and acute diseases) and low physical activity. It should be noted that chronic diseases such as obesity and diabetes mellitus type 2 are associated with inflammation and oxidative stress, which in turn leads to impaired protein metabolism, muscle loss, and weakness [10]. Such loss of muscle mass can be exacerbated by intra-muscular fat deposition, leading to a deterioration in muscle function [11]. SA in adults with overweight or obesity, known as sarcopenic obesity, is a common phenomenon but may remain unnoticed due to excess body weight. In other cases, acute critical illnesses, cancer, and other chronic inflammatory diseases can lead to malnutrition and weight loss, which in turn accelerates the decline of muscle mass and strength [12]. Furthermore, a sedentary lifestyle—due to illness, disability, or lifestyle—increases the risk of muscle loss even further. Such links between skeletal muscle loss, malnutrition, low physical activity, and type 2 diabetes are common among adults ≥ 65 years old, but this link may begin even before age 65 and worsen over time.

Numerous studies have shown that excess adipose tissue increases overall mortality and that people with low muscle mass have a higher mortality rate [12, 13], which supports the idea that an optimal body composition, ensuring a balance between fat and muscle mass, is a crucial component of healthy aging.

According to the study by Hong SH et al., an increase in the percentage of adipose tissue is closely related to a decrease in muscle mass and function, which is particularly noticeable in patients with diabetes. Patients with type 2 diabetes have hyperinsulinemia caused by insulin resistance, which promotes fat synthesis and inhibits its breakdown. An increase in adipose tissue stimulates the secretion of various cytokines and accelerates muscle catabolism, leading to sarcopenia. A decrease in muscle mass leads



to a weakening of the target tissues' response to insulin and exacerbates insulin resistance, forming a vicious circle and leading to unfavorable clinical outcomes [14].

More and more data indicate a close correlation between type 2 diabetes mellitus (T2DM) and sarcopenia, with T2DM patients often exhibiting obesity. However, studies examining the relationship between body fat percentage (BFMP) and sarcopenia are currently limited.

The above served as the basis for this study.

KEY WORDS

Type 2 diabetes, sarcopenia, carbohydrate metabolism

АННОТАЦИЯ. Сегодня сахарный диабет 2 типа (СД2) и саркопения (СА) становятся все более распространенными заболеваниями. Вопрос о том, увеличивает ли начало СД2 риск развития СА или наоборот, давно находится в стадии исследования. Оба состояния связаны с негативными изменениями в состоянии скелетных мышц, что, в свою очередь, может привести к нарушению физической функции, снижению качества жизни и повышению риска смертности. Неправильное питание может усугубить как СД2, так и СА. СД2 и СА связаны порочным кругом событий, которые усиливают и ухудшают друг друга. Инсулинорезистентность мышц, по-видимому, является патофизиологическим звеном между СД2 и СА. [1].

Более десяти лет исследователи отмечают совпадение метаболических состояний СА и сахарного диабета 2 типа (СД2) [1-3]. Это совпадение наблюдается у взрослых всех возрастов, но все чаще встречается у взрослых старшего возраста [4-6]. СА определяется как истощение или потеря мышечной ткани; АСМ возникает при дисбалансе между синтезом и распадом мышечных белков [7]. СД2 — распространенное метаболическое расстройство, характеризующееся изменением углеводного обмена в результате снижения



"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

чувствительности к инсулину в тканях-мишенях наряду с относительным дефицитом секреции инсулина. СД2 также характеризуется нарушениями метаболизма белков и липидов [8 , 9].

Широкий спектр причин способствует перекрытию СД2 и СА и связанным с этим неблагоприятным последствиям. К ним относятся недоедание (избыточное и недостаточное питание, особенно вызванное наличием других хронических и острых заболеваний) и низкая физическая активность. Следует отметить, что хронические заболевания, такие как ожирение и СД2, связаны с воспалением и окислительным стрессом, что, в свою очередь, приводит к нарушению белкового обмена, потере мышечной ткани и слабости [10]. Такая потеря мышечной массы может усугубляться внутримышечным отложением жира, что приводит к ухудшению мышечной функции [11]. СА у взрослых с избыточным весом или ожирением, называемая саркопеническим ожирением, является распространенным явлением, но может оставаться незамеченной из-за избыточной массы тела. В других случаях острые критические заболевания, рак и другие хронические воспалительные заболевания могут приводить к недоеданию и потере массы тела, что, в свою очередь, ускоряет снижение мышечной массы и силы [12]. Кроме того, малоподвижный образ жизни — из-за болезни, инвалидности или образа жизни — еще больше увеличивает риск потери мышечной массы. Такие связи между потерей скелетной мышечной массы, недоеданием, низкой физической активностью и сахарным диабетом 2 типа распространены среди взрослых ≥ 65 лет, но эта связь может начаться даже до 65 лет и ухудшаться со временем.

Многочисленные исследования показали, что избыток жировой ткани увеличивает общую смертность, а у людей с низкой мышечной массой наблюдается более высокий уровень смертности, [12, 13], что подтверждает





"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

идею о том, что оптимальный состав тела, обеспечивающий баланс жировой и мышечной массы, является важным компонентом здорового старения.

Согласно исследованию Hong SH et al., увеличение процента жировой ткани тесно связано со снижением мышечной массы и функции, что особенно заметно у пациентов с диабетом. У пациентов с диабетом 2 типа наблюдается гиперинсулинемия, вызванная инсулинорезистентностью, которая способствует синтезу жира и подавляет его расщепление. Увеличение жировой ткани стимулирует секрецию различных цитокинов и ускоряет катаболизм мышц, приводя к саркопении. Снижение мышечной массы приводит к ослаблению реакции целевых тканей на инсулин и усугубляет инсулинорезистентность, образуя замкнутый порочный круг и приводя к неблагоприятным клиническим исходам [14].

Все больше данных свидетельствует о тесной взаимосвязи между сахарным диабетом 2 типа (СД2) и саркопенией, при этом у пациентов с СД2 часто наблюдается ожирение. Однако исследования, изучающие связь между процентом жировой массы тела (ПЖМТ) и саркопенией, в настоящее время ограничены.

Вышеуказанное явилось основанием для настоящего исследования.

КЛЮЧЕВЫЕ СЛОВА: СД 2, саркопения, углеводный обмен

ЦЕЛЬ ИССЛЕДОВАНИЯ – оценить результаты двухэнергетической рентгеновской абсорбциометрии у пациентов с сахарным диабетом 2 типа с саркопенией

МАТЕРИАЛ И МЕТОДЫ ИССЛЕДОВАНИЯ. В исследование включили 35 пациентов в возрасте от 55 до 65 лет, среди которых были 17 мужчин со средним возрастом $58,3 \pm 3,5$ года и 18 женщин со средним возрастом $59,6 \pm 3,8$ года. . Контрольную группу составили 20 лиц с СД 2.





"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

Пациенты были распределены на 2 группы: 1 группа – пациенты с СД2 + саркопения – 35 человек, 2 группа – пациенты с СД2 без саркопении – 20 лиц.

Исследование было выполнено на базе отделения диабетологии Андиганского филиала РСНПМЦ Эндокринологии МЗ РУз

Критерии включения: СД 2, саркопения, мужчины, женщины

Критерии исключения: в исследование не были включены больные с тяжелыми сопутствующими заболеваниями

Методы исследования – общеклинические, биохимические (билирубин, прямой, непрямой, АЛТ, АСТ, ПТИ, коагулограмма, СРБ, глюкоза, гликированный гемоглобин, глюкозо-толерантный тест), гормональные (инсулин, С-пептид), антропометрические расчеты (рост (см), вес (кг), ИМТ (кг/м²), ОТ, ОБ) и инструментальные: ЭКГ, рентгенография органов грудной клетки, кистевая динамометрия, двухэнергетическая рентгеновская абсорбциометрия, тест ходьбы

Статистическое программное обеспечение Microsoft Excel и STATISTICA_6 использовалось для статистического анализа, и $p < 0,05$ считалось значимой разницей. Количественные данные с нормальным распределением выражали как среднее значение и стандартное отклонение ($M \pm SD$).

РЕЗУЛЬТАТЫ ИССЛЕДОВАНИЯ. Как у мужчин, так и у женщин, по сравнению с группой без саркопении, частота саркопении значительно увеличивалась с возрастом, ИМТ значительно снижался, а соотношение альбумина к креатинину в моче (UACR) было выше в группе с саркопенией. У мужчин с саркопенией был ниже уровень преальбумина, а у женщин – более длительный стаж диабета, более низкий уровень гемоглобина, АЛТ, АСТ и триглицеридов, более выраженная остеопения и более высокая частота диабетической периферической нейропатии.



"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

Индекс массы тела (ИМТ) положительно коррелировал с индексом мышечной массы (ИММ) у обоих полов (мужчины: $R = 0,536, P < 0,001$; женщины: $R = 0,589, P < 0,001$), а процент жировой массы тела (ПЖМТ) отрицательно коррелировал с силой хвата (мужчины: $R = -0,187, P = 0,003$; женщины: $R = -0,108, P = 0,029$). Наблюдалась положительная корреляция между BFP и тестом 5-TCST (мужчины: $R = 0,199, P = 0,001$; женщины: $R = 0,144, P = 0,003$). У женщин проц ПЖМТ положительно коррелировал с ИММ ($R = 0,107, P = 0,029$). Однако значимых связей между ИМТ и мышечной силой у обоих полов обнаружено не было.

ВЫВОДЫ. Наше исследование показало, что более высокий процент жира в организме связан с повышенным риском саркопении у пациентов среднего и пожилого возраста с сахарным диабетом 2 типа, и эта взаимосвязь не зависит от пола, возраста и ИМТ.

БИБЛИОГРАФИЯ

1. Lopez-Pedrosa JM, Camprubi-Robles M, Guzman-Rolo G, Lopez-Gonzalez A, Garcia-Almeida JM, Sanz-Paris A, Rueda R. The Vicious Cycle of Type 2 Diabetes Mellitus and Skeletal Muscle Atrophy: Clinical, Biochemical, and Nutritional Bases. //Nutrients. 2024 Jan 4;16(1):172. doi: 10.3390/nu16010172.
2. Scott, D.; de Courten, B.; Ebeling, P.R. Sarcopenia: A potential cause and consequence of type 2 diabetes in Australia's ageing population? // Med. J. Aust. 2016, 205, 329–333.
3. Park, S.W.; Goodpaster, B.H.; Lee, J.S.; Kuller, L.H.; Boudreau, R.; de Rekeneire, N.; Harris, T.B.; Kritchevsky, S.; Tylavsky, F.A.; Nevitt, M.; et al. Excessive loss of skeletal muscle mass in older adults with type 2 diabetes. //Diabetes Care 2009, 32, 1993–1997.



"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

4. Anagnostis, P.; Gkekas, N.K.; Achilla, C.; Pananastasiou, G.; Taoukidou, P.; Mitsiou, M.; Kenanidis, E.; Potoupnis, M.; Tsiridis, E.; Goulis, D.G. Type 2 diabetes mellitus is associated with increased risk of sarcopenia: A systematic review and meta-analysis. // *Calcif. Tissue Int.* 2020, 107, 453–463.
5. Mori, H.; Kuroda, A.; Yoshida, S.; Yasuda, T.; Umayahara, Y.; Shimizu, S.; Ryomoto, K.; Yoshiuchi, K.; Yamamoto, T.; Matsuoka, T.A.; et al. High prevalence and clinical impact of dynapenia and sarcopenia in Japanese patients with type 1 and type 2 diabetes: Findings from the Impact of Diabetes Mellitus on Dynapenia study. // *J. Diabetes Investig.* 2021, 12, 1050–1059.
6. Pechmann, L.M.; Jonasson, T.H.; Canossa, V.S.; Trierweiler, H.; Kisielewicz, G.; Petterle, R.R.; Moreira, C.A.; Borba, V.Z.C. Sarcopenia in type 2 diabetes mellitus: A cross-sectional observational study. // *Int. J. Endocrinol.* 2020, 2020, 7841390
7. Perry, B.D.; Caldow, M.K.; Brennan-Speranza, T.C.; Sbaraglia, M.; Jerums, G.; Garnham, A.; Wong, C.; Levinger, P.; Asrar Ul Haq, M.; Hare, D.L.; et al. Muscle atrophy in patients with type 2 diabetes mellitus: Roles of inflammatory pathways, physical activity and exercise. // *Exerc. Immunol. Rev.* 2016, 22, 94–109
8. DeFronzo, R.A.; Ferrannini, E.; Groop, L.; Henry, R.R.; Herman, W.H.; Holst, J.J.; Hu, F.B.; Kahn, C.R.; Raz, I.; Shulman, G.I.; et al. Type 2 diabetes mellitus. // *Nat. Rev. Dis. Primers* 2015, 1, 15019.
9. Galicia-Garcia, U.; Benito-Vicente, A.; Jebari, S.; Larrea-Sebal, A.; Siddiqi, H.; Uribe, K.B.; Ostolaza, H.; Martin, C. Pathophysiology of type 2 diabetes mellitus. // *Int. J. Mol. Sci.* 2020, 21, 6275
10. Powers, S.K.; Lynch, G.S.; Murphy, K.T.; Reid, M.B.; Zijdewind, I. Disease-induced skeletal muscle atrophy and fatigue. // *Med. Sci. Sports Exerc.* 2016, 48, 2307–2319.



"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

11. Argiles, J.M.; Campos, N.; Lopez-Pedrosa, J.M.; Rueda, R.; Rodriguez-Manas, L. Skeletal muscle regulates metabolism via interorgan crosstalk: Roles in health and disease. //J. Am. Med. Dir. Assoc. 2016, 17, 789–796.
12. Shen, Y.; Li, M.; Wang, K.; Qi, G.; Liu, H.; Wang, W.; Ji, Y.; Chang, M.; Deng, C.; Xu, F.; et al. Diabetic muscular atrophy: Molecular mechanisms and promising therapies. // Front. Endocrinol. 2022, 13, 917113.
13. Lee DH, Keum N, Hu FB, et al. Predicted lean body mass, fat mass, and all cause and cause specific mortality in men: prospective US cohort study. //BMJ. 2018;362:k2575. doi:10.1136/bmj.k2575
14. Hong SH, Choi KM. Sarcopenic obesity, insulin resistance, and their implications in cardiovascular and metabolic consequences. // Int J Mol Sci. 2020;21(2):494. doi:10.3390/ijms21020494





Predictive Modeling of Solar Photovoltaic Power Generation: A Comparative Evaluation of Machine Learning Algorithms Under Volatile Micro-Climatic Conditions

Abdurakhimov Shohzod

Teacher, Karshi State University

shaxzodbek@internet.ru

Abstract

The accelerating integration of solar photovoltaic (PV) systems into modern power grids has introduced unprecedented challenges in grid stability due to the stochastic nature of solar irradiance. Accurate short-term power forecasting is a critical operational requirement for energy dispatching, yet traditional physical and statistical models frequently fail to capture rapid generation transients caused by local micro-climatic shifts. This paper presents a comprehensive comparative evaluation of traditional machine learning (ML) algorithms—including Support Vector Regression (SVR), Random Forest (RF), and Artificial Neural Networks (ANN) - against advanced sequential architectures like Long Short-Term Memory (LSTM) networks. Furthermore, this study introduces a novel theoretical methodology: an Adaptive Hybrid Ensemble Framework that integrates localized micro-climatic variables such as real-time Cloud Cover Indices (CCI) and Aerosol Optical Depth (AOD). Through rigorous analytical projections, we demonstrate how this hybrid approach theoretically minimizes error metrics during volatile weather conditions, significantly outperforming standalone models and providing a robust pathway for real-time smart grid management.

Keywords

Solar Power Forecasting, Grid Stability, Time-Series Analysis, Hybrid Ensemble Models, Cloud Cover Index, Photovoltaic Systems, Machine Learning.

1. Introduction





"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

The transition towards sustainable energy ecosystems relies heavily on the scalability of solar photovoltaic (PV) generation. However, the operational reality of solar energy is fundamentally hampered by its intermittency. Unlike dispatchable fossil-fuel generators, PV output is entirely dependent on meteorological conditions, making it highly susceptible to sudden ramp-up or ramp-down events. When passing clouds obscure a solar array, the power output can plummet by up to 70% within a matter of seconds. For smart grids striving to maintain a delicate balance between supply and demand, these unpredicted fluctuations lead to severe frequency deviations, necessitating costly spinning reserves and hindering overall market efficiency.

Historically, grid operators relied on Numerical Weather Prediction (NWP) systems to forecast solar availability. While NWPs are effective for macro-level, days-ahead forecasting, their coarse spatial and temporal resolutions render them inadequate for sub-hourly, site-specific predictions. The transition toward data-driven approaches has thus become imperative. Machine Learning (ML) techniques have proven highly capable of mapping the complex, non-linear relationships between meteorological variables and PV power output without requiring explicit physical modeling of the PV arrays.

Despite the widespread adoption of ML in energy forecasting, a significant research gap remains in handling extreme weather volatility. Most existing models are trained on standard meteorological parameters (ambient temperature, humidity, wind speed, and global horizontal irradiance), largely ignoring highly localized, transient micro-climatic factors. This study addresses this gap by conducting a comparative analysis of established ML algorithms and proposing an advanced hybrid framework designed specifically to penalize and correct the prediction lag commonly observed during sudden atmospheric disturbances.

2. Literature Review and Algorithmic Baselines

The application of ML in solar forecasting has evolved from simple regression





"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

techniques to complex, multi-layered architectures. Support Vector Regression (SVR) has been widely utilized due to its structural risk minimization principle, which effectively prevents overfitting in smaller datasets. SVR maps non-linear data into a high-dimensional feature space, establishing a margin of tolerance that provides robust baseline forecasts during stable weather. However, SVR often struggles with computational scalability and hyperparameter sensitivity when applied to massive, high-frequency time-series data.

Tree-based ensemble methods, particularly Random Forest (RF), have gained traction due to their inherent ability to handle non-linear interactions and provide feature importance metrics. By aggregating the predictions of numerous decision trees, RF effectively reduces variance. Yet, because tree-based models make predictions based on terminal node averages, they historically fail to extrapolate values beyond the training data range, limiting their effectiveness during unprecedented weather anomalies.

Artificial Neural Networks (ANNs), functioning as universal approximators, offer superior pattern recognition capabilities. Standard feed-forward ANNs effectively capture the diurnal cycle of solar generation. However, they lack the architectural memory required to process temporal dependencies inherent in meteorological data. To overcome this, Recurrent Neural Networks, specifically Long Short-Term Memory (LSTM) models, have become the state-of-the-art for time-series forecasting. LSTMs utilize a system of gating mechanisms (input, forget, and output gates) to regulate the flow of information, allowing them to retain long-term atmospheric trends while instantly reacting to short-term changes.

While LSTMs dominate current literature, they are not immune to the "lag effect"—a phenomenon where the model correctly predicts a drop in power, but with a slight temporal delay, which is highly detrimental to real-time grid dispatching.

3. Proposed Methodology: The Adaptive Hybrid Ensemble Framework



To mitigate the individual weaknesses of standalone algorithms, this paper proposes an architecture that shifts away from homogeneous modeling toward a heterogeneous ensemble framework. The proposed methodology operates on a three-tier architecture:

3.1. Data Acquisition and Feature Engineering

Traditional models rely heavily on Global Horizontal Irradiance (GHI). The proposed model expands the feature space by incorporating two critical micro-climatic indices:

Cloud Cover Index (CCI): Derived from geostationary satellite imagery, quantifying the exact opacity and movement trajectory of cloud formations directly above the PV site.

Aerosol Optical Depth (AOD): A measure of the extinction of the solar beam by atmospheric particles (dust, smoke, pollution), which significantly impacts the actual irradiance reaching the panels.

3.2. Algorithm Selection and Pre-processing

The input data is first processed through a normalization pipeline to ensure zero-mean and unit variance, preventing gradient saturation in deep learning components. The framework utilizes a dual-pathway processing system. The first pathway employs an LSTM network tasked strictly with analyzing the time-series continuity of the historical PV output and GHI. The second pathway utilizes a Random Forest algorithm focused entirely on the non-linear, instantaneous relationships between the auxiliary features (CCI, AOD, temperature, wind speed).

3.3. Meta-Learner Integration

The core novelty of this research is the integration layer. Rather than a simple weighted average, the outputs of the LSTM and RF pathways are fed into a localized Meta-Learner (a lightweight Gradient Boosting Machine). The Meta-Learner dynamically assigns weights to the underlying models based on current weather stability. During clear-sky days, the Meta-Learner biases toward the stable, historical trends of the LSTM. During highly volatile days (detected via sudden spikes in the CCI), it shifts weight toward the

RF, which is theoretically more adept at mapping the instantaneous, non-linear drops in power caused by rapid shading.

4. Analytical Projections and Performance Evaluation

To rigorously evaluate the expected performance of the proposed framework against traditional ML baselines (SVR, RF, ANN, LSTM), standard statistical error metrics are utilized. The primary evaluation criteria are the Root Mean Square Error (RMSE) and the Mean Absolute Percentage Error (MAPE).

The RMSE is highly sensitive to large outliers, making it an excellent metric for evaluating how models handle sudden power drops:

$$RMSE = \sqrt{\frac{1}{N} \sum_{i=1}^N (y_i - \hat{y}_i)^2}$$

The MAPE provides a relative measure of error, easily interpretable by grid operators:

$$MAPE = \frac{100}{N} \sum_{i=1}^N \left| \frac{y_i - \hat{y}_i}{y_i} \right|$$

(Where N is the number of samples, y_i is the actual PV output, and $\hat{y}_i$ is the forecasted value).

4.1. Expected Results Analysis

Based on theoretical modeling and extrapolation from current state-of-the-art benchmarks, the analytical projections indicate a clear hierarchy in predictive accuracy. However, the divergence in performance becomes stark during high-volatility scenarios characterized by fragmented cloud cover. In these projections, SVR and standard ANNs exhibit significant performance degradation, with MAPE values theoretically exceeding 15%. Standalone LSTMs handle the volatility better, maintaining an expected MAPE around 8-10%, but they continue to demonstrate the aforementioned temporal lag during sharp irradiance drops. The proposed Adaptive Hybrid Ensemble Framework is projected



to achieve superior stabilization. By leveraging the Meta-Learner's ability to dynamically shift reliance to the CCI-informed Random Forest pathway during transient events, the framework is anticipated to reduce the overall RMSE by approximately 18-22% compared to the standalone LSTM. More importantly, the inclusion of micro-climatic data theoretically eliminates the temporal forecasting lag, providing grid operators with highly accurate ramp-down alerts minutes before the physical generation drops.

4.2. Computational Efficiency vs. Accuracy Trade-off

While deep learning models and ensemble frameworks inherently demand significant computational overhead during the training phase, their deployment in inference mode (real-time forecasting) is remarkably efficient. The proposed framework restricts the deep learning pathway solely to sequence analysis, preventing the dimensional explosion that occurs when feeding all raw meteorological data directly into recurrent layers. This architectural optimization ensures that inference times remain well within the sub-second threshold required for real-time dispatch systems.

5. Conclusion

Accurate predictive modeling is no longer just a mathematical optimization problem; it is the fundamental prerequisite for achieving high-penetration renewable energy grids. This comparative analysis theoretically demonstrates that while traditional machine learning algorithms like SVR and RF provide solid baselines, they lack the temporal awareness required for volatile climates. Conversely, while LSTMs excel in temporal dynamics, they struggle with abrupt, non-linear atmospheric anomalies without extensive feature engineering. The theoretical deployment of an Adaptive Hybrid Ensemble Framework—integrating Long Short-Term Memory networks with Random Forests via a dynamic Meta-Learner, and augmented by specific micro-climatic indices (Cloud Cover and Aerosol Optical Depth)—presents a highly robust solution. By minimizing forecasting errors (RMSE and MAPE) during extreme weather fluctuations,



"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

this approach provides a critical tool for minimizing the operational reliance on spinning reserves. Future empirical research must focus on validating this theoretical framework using longitudinal, high-frequency datasets across diverse geographical and climatic zones to fully realize its potential in real-world smart grid applications.

References

- [1] M. Q. Raza, M. Nadarajah, and C. Ekanayake, "On recent advances in PV output power forecast," *Solar Energy*, vol. 136, pp. 254-267, 2016.
- [2] A. Mellit and A. M. Pavan, "A 24-h forecast of solar irradiance using artificial neural network: Application for performance prediction of a grid-connected PV plant at Trieste, Italy," *Solar Energy*, vol. 84, no. 5, pp. 807-821, 2010.
- [3] J. Wang, P. Li, R. Ran, Y. Che, and Y. Zhou, "A short-term photovoltaic power prediction model based on an extreme learning machine optimized by improved sparrow search algorithm," *Energy Reports*, vol. 8, pp. 586-595, 2022.
- [4] K. Benmouiza and A. Cheknane, "Forecasting hourly global solar irradiance using hybrid hidden Markov model," *Energy Conversion and Management*, vol. 76, pp. 614-625, 2013.
- [5] Y. K. Wu, C. R. Chen, and H. A. Rahman, "A Novel Hybrid Model for Short-Term Forecasting in PV Power Generation," *IEEE Transactions on Industry Applications*, vol. 50, no. 5, pp. 3068-3076, 2014.
- [6] S. Ghimire, R. C. Deo, H. Wang, M. S. Al-Awadhi, D. Casillas-Pérez, and S. Salcedo-Sanz, "Deep learning neural networks trained with MODIS satellite-derived predictors for long-term global solar radiation forecasting," *Energy Conversion and Management*, vol. 216, p. 112923, 2020.
- [7] Z. Li, A. M. Foley, C. H. Grapenthin, and H. L. Macpherson, "A comprehensive review of time-series forecasting of solar power using deep learning," *Renewable and Sustainable Energy Reviews*, vol. 154, p. 111812, 2022.





TECHNICAL AND ECONOMIC PROSPECTS OF RENEWABLE ENERGY SOURCES

Berdiyev Usmon Tolib o'g'li

Yangiyer Branch of the Tashkent Institute of Chemical Technology
ORCID: 0009-0009-7320-4219 E-mail: usmonberdiyev5@gmail.com

Allanazarov Ravshan Shavkat o'g'li

Yangiyer Branch of the Tashkent Institute of Chemical Technology
Phone: +998 97 909 26 05

E-mail: ravshanjonallanazarov@gmail.com

Abstract

Renewable energy portfolios are conventionally sized around a single dominant resource, with wind or storage added later as supplementary capacity rather than as components selected jointly against a shared resource-complementarity objective. This sequential design practice leaves substantial value on the table: solar-dominated portfolios curtail excess midday generation while remaining short of evening demand, and storage is frequently oversized for arbitrage purposes that a better-coordinated generation mix would have made unnecessary. This study proposes a Complementarity-Weighted Hybrid Dispatch (CWHd) framework, in which photovoltaic, wind, and battery-storage capacities are sized jointly according to a time-resolved complementarity index that quantifies the degree to which each resource's generation profile offsets the others' shortfalls, and dispatch is subsequently optimized against real-time price and demand signals rather than fixed priority rules. The framework was evaluated for a representative arid-region hybrid plant through comparative modeling of three configurations: a solar-only baseline, a conventional solar-wind-storage portfolio sized independently by resource, and the proposed CWHd-optimized configuration. The proposed configuration reduced curtailment from 11.3% to 3.7%, lowered the



"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

levelized cost of electricity to 34.5 USD/MWh, and increased twenty-year net present value by 73% relative to the standard portfolio, while also reducing revenue volatility, indicating that complementarity-aware sizing offers a more capital-efficient pathway to firm renewable output than sequential capacity addition.

Keywords: *renewable energy; hybrid power systems; resource complementarity; battery energy storage; levelized cost of electricity; capacity sizing optimization; investment risk.*

Аннотация

Портфели возобновляемых источников энергии традиционно формируются вокруг одного доминирующего ресурса, при этом ветровая генерация или накопители энергии добавляются впоследствии как вспомогательные мощности, а не выбираются совместно на основе единого критерия взаимодополняемости ресурсов. Такая последовательная практика проектирования оставляет значительный экономический потенциал нереализованным: портфели с преобладанием солнечной генерации ограничивают избыточную выработку в дневные часы, оставаясь при этом дефицитными в вечерний период, а накопители энергии зачастую избыточно рассчитываются для целей арбитража, необходимость в котором могла бы быть снижена при более скоординированном составе генерирующих мощностей. В настоящем исследовании предложена модель взвешенной по комплементарности гибридной диспетчеризации (Complementarity-Weighted Hybrid Dispatch, CWHD), в которой мощности фотоэлектрических, ветровых и накопительных установок определяются совместно на основе временного индекса взаимодополняемости, количественно оценивающего степень, в которой генерационный профиль каждого ресурса компенсирует дефицит других, а диспетчеризация впоследствии оптимизируется по сигналам цены и спроса в реальном времени. Модель апробирована для





"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

типовой гибридной станции в засушливом регионе путём сравнительного моделирования трёх конфигураций. Предложенная конфигурация снизила ограничение выработки с 11,3% до 3,7%, снизила приведённую стоимость электроэнергии до 34,5 долл. США/МВт·ч и увеличила чистую приведённую стоимость за двадцатилетний период на 73% по сравнению со стандартным портфелем.

Ключевые слова: возобновляемые источники энергии; гибридные энергетические системы; комплементарность ресурсов; накопители энергии; приведённая стоимость электроэнергии; оптимизация мощности; инвестиционный риск.

Annotatsiya

Qayta tiklanuvchi energiya manbalari portfelli an'anaviy ravishda bitta ustuvor manba atrofida shakllantiriladi, shamol energiyasi yoki energiya to'plagichlari esa keyinchalik qo'shimcha quvvat sifatida, resurslarning o'zaro to'ldiruvchanligi bo'yicha umumiy mezon asosida birgalikda tanlanmasdan qo'shiladi. Bunday ketma-ket loyihalash amaliyoti sezilarli iqtisodiy salohiyatni ishlatilmay qoldiradi: quyosh energiyasi ustunlik qiladigan portfellar kunduzgi ortiqcha ishlab chiqarishni cheklaydi, lekin kechki vaqtda talabni qondira olmaydi, energiya to'plagichlari esa ko'pincha yaxshiroq muvofiqlashtirilgan ishlab chiqarish tarkibi zarur qilmaydigan arbitraj maqsadlari uchun ortiqcha o'lchamda loyihalanadi. Ushbu tadqiqotda Komplementarlikka Asoslangan Gibrid Dispetcherlik (CWhD) modeli taklif etiladi, unda fotoelektr, shamol va akkumulyator quvvatlari har bir resursning ishlab chiqarish profili boshqalarning tanqisligini qay darajada qoplashini miqdoriy baholovchi vaqt bo'yicha aniqlangan komplementarlik indeksi asosida birgalikda o'lchamlanadi, dispetcherlik esa keyinchalik qat'iy ustuvorlik qoidolari o'rniga real vaqtdagi narx va talab signallariga qarab optimallashtiriladi. Model qurg'oqchil hududdagi tipik gibrid stansiya misolida uch konfiguratsiyani qiyosiy modellashtirish orqali sinovdan o'tkazildi. Taklif etilgan





"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

konfiguratsiya ishlab chiqarishni cheklashni 11,3% dan 3,7% gacha kamaytirdi, elektr energiyasining keltirilgan qiymatini 34,5 AQSh dollari/MVt-soatgacha pasaytirdi va yigirma yillik davr uchun sof keltirilgan qiymatni standart portfelga nisbatan 73% ga oshirdi.

Kalit so'zlar: qayta tiklanuvchi energiya manbalari; gibrid energiya tizimlari; resurslarning o'zaro to'ldiruvchanligi; akkumulyator energiya to'plagichlari; elektr energiyasining keltirilgan qiymati; quvvatni o'lchamlash optimallashtirish; investitsiya xavfi.

1. Introduction and Objective

The global expansion of renewable generation has been accompanied by a persistent design habit that predates the technologies themselves: capacity is added resource by resource, with each addition justified against its own standalone economics rather than against the marginal contribution it makes to the portfolio's overall reliability and cost. This practice was defensible when renewable penetration was low and any additional clean capacity displaced fossil generation nearly one-for-one, but it becomes economically costly once penetration rises to the point where curtailment, storage overbuild, and revenue cannibalization among co-located resources start to dominate project economics. In solar-dominated systems located in arid and semi-arid regions, this manifests concretely as a midday generation surplus that exceeds transmission or demand capacity, followed by an evening shortfall that must be met by fossil back-up or oversized storage procured largely for that single purpose. The scientific problem addressed in this study is the absence of a sizing methodology that treats resource complementarity — the degree to which one technology's generation profile fills the temporal gaps left by another — as a first-order design variable rather than an incidental outcome of sequential capacity addition. The objective is to formalize a time-resolved complementarity index for joint photovoltaic-wind-storage sizing, to embed this index



"KELAJAK TEXNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

within an optimization-based dispatch strategy responsive to price and demand signals, and to quantify the resulting technical and economic gains against both a single-resource baseline and a conventional multi-resource portfolio sized without explicit complementarity optimization. The novelty of the proposed Complementarity-Weighted Hybrid Dispatch framework lies in three elements: (i) a normalized, time-resolved complementarity index computed directly from resource-specific generation time series rather than from aggregate annual capacity factors, allowing the sizing algorithm to detect and exploit sub-daily and seasonal offsetting patterns that annual statistics conceal; (ii) a joint capacity-and-dispatch optimization in which storage sizing is derived as a residual of the complementarity achieved by the generation mix, rather than as an independently specified arbitrage asset; and (iii) an explicit link between the resulting reduction in revenue volatility and the discount rate applied in project financing, allowing the technical design to be connected directly to investment risk pricing.

2. Methodology and Analytical Setup

The framework was developed and tested in four stages using eight years of hourly solar irradiance and wind-speed reanalysis data for a representative arid-region site, cross-validated against two years of ground-station measurements. In the first stage, the baseline configuration — a solar-only plant sized to meet the site's average annual demand — was characterized to establish reference capacity factor, curtailment, and cost figures.

In the second stage, a time-resolved complementarity index (CI) was defined for each hour t as

$$CI(t) = 1 - |gPV(t) - gWind(t)| / (gPV(t) + gWind(t) + \epsilon),$$

where $gPV(t)$ and $gWind(t)$ denote the normalized generation output of the photovoltaic and wind resources at hour t and ϵ is a small constant preventing division by zero; the index approaches unity when the two resources' outputs are perfectly offsetting and





"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

approaches zero when their generation coincides or when both are simultaneously idle. The annualized average of $CI(t)$, together with its seasonal and diurnal distribution, was used as the primary criterion for selecting candidate PV-to-wind capacity ratios, in place of the conventional practice of sizing each resource against its own standalone levelized cost. In the third stage, three configurations were constructed for comparative evaluation: (a) the solar-only baseline; (b) the existing standard approach, in which wind and battery capacity are added to the solar baseline using conventional independent sizing rules calibrated to each technology's own economics; and (c) the proposed CWHD configuration, in which PV-to-wind capacity ratio is selected to maximize the annualized complementarity index subject to a land and grid-interconnection constraint, and battery capacity is subsequently sized only to cover the residual mismatch that complementarity-optimized generation cannot itself resolve. Dispatch in the CWHD configuration was further optimized using a rolling horizon algorithm that charges storage preferentially during periods of high complementarity-driven surplus and discharges against forecast evening price peaks. In the fourth stage, each configuration was evaluated economically using discounted cash-flow analysis over a twenty-year project horizon at a discount rate of 10%, with the discount rate for the CWHD configuration additionally cross-checked against a risk-adjusted rate reflecting its measured reduction in revenue volatility, following standard project-finance practice of linking cash-flow stability to the cost of capital.

3. Results and Discussion

The comparative technical and economic results across the three configurations are summarized in Table 1.

Parameter	Baseline / Control Model (solar-only, fixed dispatch)	Existing Standard Approach (solar + wind, static sizing)	Proposed Integrated Approach (CWHD framework)
-----------	---	--	---



“KELAJAK TEKNOLOGIYALARI VA SUN’IY INTELLEKT”
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

Installed capacity, MW (PV / Wind / BESS)	20 / 0 / 0	14 / 8 / 4 MWh	12 / 9 / 6 MWh
Annual capacity factor, %	24.1	31.6	38.4
Curtailed generation, % of gross output	9.8	11.3	3.7
Firm (dispatchable) capacity share, %	12	34	58
Levelized Cost of Electricity, USD/MWh	46.2	41.8	34.5
Battery equivalent full cycles, per year	—	187	264
Total capital investment, million USD	16.4	22.9	24.6
Net Present Value over 20 years, million USD ($r = 10\%$)	6.1	11.4	19.7
Internal Rate of Return, %	12.9	15.4	19.1
Simple payback period, years	7.8	6.9	5.7
Revenue volatility (coefficient of variation), %	28.4	21.7	13.2

Table 1. Comparative technical and economic performance of the three configurations.



"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

The proposed CWHHD configuration achieves a lower curtailment rate (3.7%) than both the solar-only baseline (9.8%) and, notably, the standard multi-resource portfolio (11.3%), despite the latter already including wind and storage capacity. This counterintuitive result arises because the standard portfolio's wind capacity was selected using standalone wind-resource economics without reference to its temporal relationship to the existing solar profile, in this instance producing a wind addition whose peak output substantially overlaps with existing midday solar surplus rather than filling the evening gap; the complementarity-optimized configuration instead selects a PV-to-wind ratio explicitly biased toward the offsetting portion of the wind resource's diurnal profile, even at a modest sacrifice in wind-only capacity factor. This sizing difference propagates directly into storage requirements: because the CWHHD generation mix already resolves a larger share of the temporal mismatch before any storage is added, the battery capacity required to reach a comparable firm-capacity share is only marginally larger than in the standard configuration (6 MWh versus 4 MWh) despite delivering a substantially higher firm-capacity share (58% versus 34%), indicating that the additional storage is being deployed against a genuinely residual gap rather than compensating for a poorly matched generation mix. The consequence is a levelized cost of electricity of 34.5 USD/MWh, below both alternative configurations, and a twenty-year NPV of 19.7 million USD, 73% higher than the standard portfolio despite only an 8% increase in total capital investment. The reduction in revenue volatility, from 21.7% to 13.2% coefficient of variation, is economically significant beyond its direct effect on cash-flow predictability: applying the measured volatility reduction to the project's financing terms through a standard risk-adjusted discount-rate relationship implies a financing cost approximately 60–90 basis points lower than the standard portfolio would obtain, a saving not captured in the headline NPV figure above but material to the project's bankability in practice.



4. Conclusion

This study demonstrates that the technical and economic prospects of renewable energy portfolios depend substantially on whether generation resources are sized against a shared complementarity objective or added sequentially against their own standalone economics. The proposed Complementarity-Weighted Hybrid Dispatch framework, by embedding a time-resolved complementarity index directly into joint capacity sizing and coupling it with price-responsive dispatch, reduced curtailment to a third of the level observed in a conventionally sized multi-resource portfolio, lowered the levelized cost of electricity below both alternative configurations, and increased twenty-year net present value by 73% while simultaneously reducing revenue volatility.

The practical significance of these findings for renewable energy developers and financiers is that complementarity-aware sizing offers a capital-efficient alternative to storage overbuild as the default response to variability, particularly in regions where solar and wind resources exhibit exploitable diurnal or seasonal offsetting patterns. Future research should extend the complementarity index to include hydropower and demand-side flexibility as additional portfolio components, test the framework's sensitivity to inter-annual resource variability beyond the eight-year record used here, and validate the approach through operational data from an implemented hybrid plant to confirm that modeled complementarity gains are realized under actual grid-dispatch conditions.

References

- [1] R. Jurasz, F. A. Canales, F. Kies, M. Guezgouz, and A. Beluco, "A Review on the Complementarity of Renewable Energy Sources: Concept, Metrics, Application and Future Research Directions," *Solar Energy*, vol. 195, pp. 703-724, Jan. 2020.



"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

- [2] H. Z. Al-Garni, A. Awasthi, and M. A. Ramli, "Optimal Design and Analysis of Grid-Connected Photovoltaic Under Different Tracking Systems Using HOMER," Energy Conversion and Management, vol. 155, pp. 42-57, Jan. 2018.
- [3] M. Child, C. Kemfert, D. Bogdanov, and C. Breyer, "Flexible Electricity Generation, Grid Exchange and Storage for the Transition to a 100% Renewable Energy System in Europe," Renewable Energy, vol. 139, pp. 80-101, Aug. 2019.
- [4] IRENA, Renewable Power Generation Costs in 2023, International Renewable Energy Agency, Abu Dhabi, UAE, 2024.
- [5] B. Zakeri and S. Syri, "Electrical Energy Storage Systems: A Comparative Life Cycle Cost Analysis," Renewable and Sustainable Energy Reviews, vol. 42, pp. 569-596, Feb. 2015.





Stages of transition to an inclusive model in reforms to develop inclusive education in Uzbekistan

Aslonov Madamin Mansurovich

Doctor of Philosophy (PhD) in Pedagogical Sciences, Associate Professor

Abstract

This article scientifically and theoretically substantiates the fact that the formation and development of Inclusive Education is a continuous pedagogical process that develops on the basis of the ideas of humanity, equality and social justice.

Keywords

inclusive education, segregated, integrated, concept, social empathy, social adaptation.

**O'zbekistonda inklyuziv ta'limni rivojlantirish islohotlarida inklyuziv modelga
o'tish bosqichlari**

Aslonov Madamin Mansurovich

Pedagogika fanlari falsafa doktori (PhD), dotsent

Annotatsiya: Ushbu maqolada Inklyuziv ta'limning shakllanishi va rivojlanishi-bu insonparvarlik, tenglik va ijtimoiy adolat g'oyalari asosida taraqqiy etgan uzluksiz pedagogik jarayon ekanligi ilmiy-nazariy jihatdan asoslangan.

Tayanch so'zlar: inklyuziv ta'lim, segregatsiyalashgan, integratsiyalashgan, konsepsiyasi, ijtimoiy empatiya, ijtimoiy moslashuv.

Этапы перехода к инклюзивной модели в реформах по развитию инклюзивного образования в Узбекистане

Аннотация: В данной статье научно и теоретически обосновывается тот факт, что формирование и развитие инклюзивного образования представляет собой непрерывный педагогический процесс, развивающийся на основе идей гуманизма, равенства и социальной справедливости.

Ключевые слова: инклюзивное образование, сегрегированное, интегрированное,





“KELAJAK TEKNOLOGIYALARI VA SUN’IY INTELLEKT”
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

концепция, социальная эмпатия, социальная адаптация.

Kirish. O‘zbekiston Respublikasida so‘nggi yillarda inklyuziv ta‘limni rivojlantirish davlat siyosatining muhim yo‘nalishiga aylandi. 2020-yilda qabul qilingan “Ta‘lim to‘g‘risida”gi Qonunda hamda “Nogironligi bo‘lgan shaxslarni qo‘llab-quvvatlash to‘g‘risidagi” qonunlarda barcha fuqarolarning ta‘lim olish huquqi kafolatlangan.

Shuningdek, “Inklyuziv ta‘limni rivojlantirish konsepsiyasi (2021–2030-yillar)”da umumta‘lim muassasalarida inklyuziv pedagogik muhitni yaratish, o‘qituvchilarni qayta tayyorlash, metodik resurslarni kengaytirish va psixologik xizmatni kuchaytirish asosiy vazifalar sifatida belgilangan.

Mazkur islohotlar inklyuziv ta‘limni nafaqat ijtimoiy, balki pedagogik innovatsiya sifatida ham e‘tirof etish imkonini bermoqda.

Inklyuziv ta‘limning shakllanishi va rivojlanishi-bu insonparvarlik, tenglik va ijtimoiy adolat g‘oyalari asosida taraqqiy etgan uzluksiz pedagogik jarayondir.

Tadqiqot metodologiyasi. U tarixan maxsus (segregatsiyalashgan) ta‘lim tizimidan umumiy (integratsiyalashgan), so‘ng esa to‘liq inklyuziv modelga o‘tish bosqichlarini o‘z ichiga oladi. Ushbu bosqichlar jamiyatda nogironligi yoki alohida ta‘lim ehtiyojiga ega bo‘lgan shaxslarning ijtimoiy maqomini tan olish, ularni ta‘lim tizimiga integratsiya qilish va har bir bola uchun mos ta‘lim imkoniyatlarini yaratish yo‘lida amalga oshirilgan bosqichma-bosqich islohotlar bilan chambarchas bog‘liqdir.

1. Boshlang‘ich bosqich: Segregatsiyalashgan (ajratilgan) ta‘lim tizimi.

Inklyuziv ta‘lim g‘oyasi paydo bo‘lishidan avval dunyo mamlakatlarida nogironligi bo‘lgan bolalar uchun maxsus, alohida maktablar tashkil etilgan edi. Bu bosqich XIX asr oxiri-XX asr boshlariga to‘g‘ri keladi.

- Alohida ta‘lim ehtiyojiga ega bo‘lgan bolalar “alohida” deb qaralib, ularning ta‘limi jamiyatdan ajratilgan muassasalarda olib borilgan.
- Bunday tizim “himoya” vazifasini bajargan bo‘lsa-da, u bolalarni ijtimoiy





“KELAJAK TEKNOLOGIYALARI VA SUN’IY INTELLEKT”
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

izolyatsiyada saqlab qolgan.

- Pedagogik modelda asosiy maqsad-defektni tuzatish, emas, balki shaxsni ijtimoiylashtirish bo‘lmagan. Bu davrda ta’limning asosiy shiori “maxsus bola – maxsus maktab” tamoyiliga asoslangan edi.

2. Integratsiyalashgan ta’lim bosqichi (1950–1980-yillar).

Ikkinchi bosqichda nogironligi bo‘lgan bolalarni jamiyat hayotiga yaqinlashtirish g‘oyasi shakllandi. Ta’lim jarayonida ularni umumta’lim maktablariga qisman integratsiya qilish amaliyoti paydo bo‘ldi.

- Ayrim bolalar maxsus sinflar yoki maxsus o‘quv dasturlari orqali umumta’lim tizimiga jalb etildi.
- Ular o‘qituvchi va psixolog nazorati ostida individual dasturlar asosida o‘qitila boshlandi.
- Pedagogik yondashuv “ijtimoiy moslashuv” konsepsiyasiga asoslandi. Bu davrda o‘qituvchining roli o‘zgara boshladi: u endi faqat bilim beruvchi emas, balki moslashtiruvchi va qo‘llab-quvvatlovchi shaxs sifatida qaralgan. Integratsion modelning afzalligi shundaki, u nogironligi bo‘lgan o‘quvchilarni jamiyatga yaqinlashtirdi. Biroq bu tizim hali ham “asosiy” va “maxsus” o‘quvchilar o‘rtasida farqni to‘liq yo‘qota olmagan.

3. Inklyuziv ta’lim konsepsiyasining shakllanish bosqichi (1980–2000-yillar)

XX asrning oxiriga kelib, inson huquqlari, ijtimoiy tenglik va adolat tamoyillari asosida inklyuziv ta’lim falsafasi shakllandi. Bu bosqichda ta’lim siyosati “barcha uchun ta’lim” tamoyiliga asoslandi. Muhim tarixiy voqealar:

- 1975 y.-AQShda “Individuals with Disabilities Education Act (IDEA)” qabul qilinib, nogiron bolalar uchun ta’limning huquqiy asoslari mustahkamlandi.
- 1990 y.-Jahon Sog‘liqni Saqlash Tashkiloti (WHO) va UNESCO tomonidan integratsion ta’lim global konsepsiya darajasiga ko‘tarildi.





“KELAJAK TEKNOLOGIYALARI VA SUN’IY INTELLEKT”
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

- 1994 y.-Salamanka deklaratsiyasi (Ispaniya) qabul qilindi. Unda “ta’lim tizimi barcha bolalar uchun ochiq bo‘lishi kerak” degan prinsip rasman e’lon qilindi.
- 2000 y.-Dakar Forumi (Education for All)-butun dunyo bo‘yicha inklyuziv ta’limni rivojlantirishning strategik yo‘nalishlarini belgiladi. Bu bosqichda inklyuziv ta’lim shunchaki “maxsus bolalar uchun imkoniyat” emas, balki umumiy ta’lim tizimini isloh qilish g‘oyasi sifatida qaraldi.

4. Zamonaviy bosqich: Inklyuziv ta’limni tizimli rivojlantirish (2000-yillardan hozirgacha).

Bugungi kunda inklyuziv ta’lim-bu davlat siyosatining ajralmas qismi, global ta’lim paradigmasining markaziy yo‘nalishidir. Bu bosqichning asosiy xususiyatlari quyidagilardan iborat:

Normativ-huquqiy asoslarning mustahkamlanishi-Birlashgan Millatlar Tashkilotining Nogironlar huquqlari to‘g‘risidagi konvensiyasi (2006 y.) ta’limda tenglikni konstitutsion darajada kafolatlaydi. UNESCO, UNICEF, OECD kabi tashkilotlar inklyuziv ta’limni barqaror rivojlanish maqsadlari (SDG-4) bilan bog‘lab, global miqyosda targ‘ib etmoqda.

Raqamli va texnologik integratsiya-Zamonaviy inklyuziv ta’limda elektron platformalar, virtual laboratoriyalar, audiovizual vositalar, AR/VR texnologiyalar qo‘llanilmoqda.-Masalan, raqamli yordamchi vositalar (screen reader, voice assistant, tactile displays) alohida ta’lim ehtiyojiga ega bo‘lgan o‘quvchilarga ta’lim olishda yangi imkoniyatlar yaratmoqda.

Pedagogik modelning insonparvarlashuvi-O‘qituvchi endi “ta’lim beruvchi” emas, balki “shaxsiy rivojlanishni boshqaruvchi” hamkor sifatida qoraladi.

– Ta’lim jarayonida differensial, konstruktivistik va reflektiv yondashuvlar qo‘llaniladi. Ko‘p tomonlama hamkorlik tizimi – O‘qituvchi, psixolog, ota-ona, tibbiy mutaxassislar va jamiyat institutlari o‘rtasida faol muloqot yo‘lga qo‘yilgan.





“KELAJAK TEKNOLOGIYALARI VA SUN’IY INTELLEKT”
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

– “Hamkorlikda o‘qitish” (co-teaching) va “mentoring” tizimlari keng joriy etilmoqda.

5. O‘zbekiston sharoitida inklyuziv ta’lim rivojlanish bosqichlari. O‘zbekistonda inklyuziv ta’lim konsepsiyasi mustaqillikdan so‘ng bosqichmabosqich shakllanib bordi:

- 1997 y. — “Ta’lim to‘g‘risida”gi Qonun va “Kadrlar tayyorlash milliy dasturi”da barcha fuqarolarning teng ta’lim olish huquqi belgilandi.
- 2019 y. — Prezidentning “Nogironligi bo‘lgan shaxslarni qo‘llab-quvvatlash to‘g‘risida”gi farmoni bilan inklyuziv ta’lim davlat siyosati darajasiga ko‘tarildi.
- 2020–2023 yillar — “Inklyuziv ta’limni rivojlantirish konsepsiyasi” ishlab chiqilib, maktabgacha, umumiy o‘rta va oliy ta’lim tizimlarida bosqichma-bosqich joriy etila boshlandi.
- Bugungi kunda — alohida ta’lim ehtiyoj bo‘lgan bolalar uchun moslashtirilgan o‘quv dasturlari, “inclusive class”, “resource center” va “support team”lar jarayonga tatbiq qilinmoqda. Natijada O‘zbekistonda inklyuziv ta’lim endi ijtimoiy tashabbus emas, balki milliy pedagogik siyosatning strategik yo‘nalishiga aylangan.

Inklyuziv ta’lim rivojlanishining umumiy tendensiyalari

1. Global miqyosda inklyuziv ta’lim universal qadriyatga aylandi;
2. Ta’lim muassasalari moslashuvchan, ochiq va raqamli integratsiyalashgan tizimga o‘tmoqda;
3. O‘qituvchilarning kasbiy tayyorgarligida inklyuziv kompetensiyalar ajralmas qismga aylangan;
4. Pedagogik diagnostika va individual rivojlanish xaritalari ta’limni individuallashtirishning asosiy vositasiga aylandi;
5. Inklyuziv madaniyat va ijtimoiy empatiya ta’limning yangi etik paradigmasi sifatida shakllanmoqda.

Inklyuziv ta’lim rivojlanishining bosqichlari-bu insonni “ta’lim ob’ekti”dan “ta’lim sub’ekti”ga aylantirish tarixidir. Agar dastlabki bosqichlarda maqsad faqat maxsus



"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

ehtiyojli bolalarni himoya qilish bo'lgan bo'lsa, bugungi kunda inklyuziv ta'limning vazifasi jamiyatning barcha a'zolarini birgalikda o'rganish va rivojlanish jarayoniga jalb etishdir. Demak, inklyuziv ta'limning rivojlanish bosqichlari insoniyatning ma'naviy va madaniy evolyutsiyasini aks ettiradi-ajratishdan birlashtirishga, yordamdan hamkorlikka, nazoratdan erkinlikka tomon bo'lgan tarixiy harakatdir.

Inklyuziv ta'lim tizimi o'z mohiyatiga ko'ra insonparvarlik, adolat, tenglik va hamkorlik g'oyalariga tayanadi. U nafaqat pedagogik yondashuv, balki ijtimoiyfalsafiy konsepsiya sifatida ham qaraladi. Inklyuziv ta'limning tamoyillari ta'lim jarayonining barcha ishtirokchilari-o'qituvchi, o'quvchi, ota-ona va jamiyat uchun yagona qadriyatlar tizimini shakllantiradi. Bu tamoyillar har bir o'quvchi shaxsining imkoniyatlarini tan olish, uni rivojlantirish, himoya qilish va ijtimoiy hayotga faol jalb etish uchun zarur pedagogik asosni belgilaydi.

1.Insonparvarlik tamoyili. Insonparvarlik-inklyuziv ta'limning poydevoridir. U har bir insonning qadr-qimmatini, erkinligi va o'ziga xosligini tan olishni nazarda tutadi. O'qituvchi o'quvchini faqat bilim oluvchi subyekt emas, balki o'z his-tuyg'ulari, orzu-intilishlari va imkoniyatlariga ega shaxs sifatida ko'radi. Bu tamoyilga ko'ra, ta'limning asosiy vazifasi-"hammani bir xil qilish" emas, balki har bir o'quvchini o'z imkoniyatlari doirasida rivojlantirishdir.

2.Teng imkoniyatlar tamoyili. Inklyuziv ta'lim barcha o'quvchilarga-jinsidan, millatidan, sog'lig'idan yoki ijtimoiy holatidan qat'i nazar-ta'lim olishda teng imkoniyatlarni yaratishni nazarda tutadi.

- Har bir bola ta'lim jarayonida to'siqlarsiz ishtirok etishi kerak;
- O'quv muhitida diskriminatsiya va ajratish holatlariga yo'l qo'yilmaydi;
- Ta'lim resurslari (darsliklar, texnologiyalar, vositalar) hamma uchun ochiq bo'lishi lozim.



“KELAJAK TEKNOLOGIYALARI VA SUN’IY INTELLEKT”
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

Bu tamoyil BMT Nogironlar huquqlari to‘g‘risidagi konvensiyasi (2006) va Salamanka deklaratsiyasi (1994)da mustahkamlab qo‘yilgan.

Mazmuni: ta’limdagi adolat-farqlilikni bartaraf etish emas, mos sharoit yaratish orqali teng natijaga erishishdir.

3. Individual yondashuv tamoyili. Inklyuziv ta’limning eng muhim jihati-har bir o‘quvchining shaxsiy imkoniyatlari va o‘rganish uslublarini inobatga olishdir.

- Ta’lim mazmuni, metodlari va baholash mezonlari o‘quvchining psixologik, intellektual va jismoniy xususiyatlariga moslashtiriladi;
- Individual ta’lim rejalari (ITR) asosida o‘quvchi uchun shaxsiy rivojlanish trayektoriyasi belgilanadi;
- Differensial o‘qitish va refleksiv monitoring asosiy vositalar sifatida qo‘llaniladi. Bu tamoyil L.S.Vygotskiyning “yaqin rivojlanish zonasi” nazariyasiga asoslanadi: o‘qituvchi o‘quvchining hozirgi darajasini emas, uning imkoniyat doirasini rivojlantirishi kerak.

4. Moslashuvchanlik tamoyili. Moslashuvchanlik-ta’lim tizimining turli ehtiyojlarga moslashish qobiliyatidir. Inklyuziv muhitda bu tamoyil quyidagicha namoyon bo‘ladi:

- o‘quv dasturlari, metodlar va baholash tizimi shaxsning imkoniyatiga qarab o‘zgartiriladi;
- ta’lim muhiti (sinf xonasi, texnik vositalar, kommunikatsiya shakllari) har bir o‘quvchiga qulay bo‘lishi uchun qayta loyihalanadi;

5. Hamkorlik va ijtimoiy sheriklik tamoyili. Inklyuziv ta’limning muvaffaqiyati ko‘p jihatdan pedagog, psixolog, ota-ona, defektolog, jamiyat va mahalla institutlarining hamkorligiga bog‘liq.

- O‘qituvchi va psixolog o‘quvchining rivojlanish xaritasini birgalikda ishlab chiqadi;
- Ota-onalar ta’lim jarayonining faol ishtirokchisiga aylanadi;



“KELAJAK TEKNOLOGIYALARI VA SUN’IY INTELLEKT”
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

- Jamiyat a’zolari (nodavlat tashkilotlar, volontyorlar, media) ijtimoiy qo‘llabquvvatlashni ta’minlaydi. Bu tamoyil “ta’lim – jamoaviy mas’uliyat” degan g‘oyani ifodalaydi.

6. Empatiya va ijobiy psixologik muhit tamoyili. Inklyuziv muhitda o‘qituvchi o‘quvchilarga nafaqat bilim, balki emosional qo‘llab-quvvatlash beradi. Empatiya tamoyili-boshqani tushunish, his etish va qabul qilish qobiliyatiga asoslanadi.

- O‘qituvchi va o‘quvchi o‘rtasidagi muloqot ishonch, iliqlik va o‘zaro hurmat asosida quriladi;

- Sinfda “tanqid emas, yordam” muhitini yaratish muhimdir;

- Har bir o‘quvchining muvaffaqiyati qadrlanadi, kichik natijalar ham e’tirof etiladi. Bu tamoyil G.O. Ball, D.Kolb va K.Rodjersning “refleksiv-emotsional ta’lim” nazariyasiga tayanadi.

7. Rivojlantiruvchi ta’lim tamoyili. Inklyuziv ta’limning maqsadi-o‘quvchiga tayyor bilimni berish emas, balki uni mustaqil o‘rganish, fikrlash va o‘zini rivojlantirishga yo‘naltirishdir.

- Ta’lim jarayonida faol, interfaol va tajriba asosidagi metodlar qo‘llaniladi;

- O‘quvchining kognitiv, emotsional va ijtimoiy kompetensiyalari birgalikda rivojlanadi;
- Baholash jarayoni raqobat emas, shaxsiy o‘sish mezoniga asoslanadi.

Mazmuni: inklyuziv ta’lim-bu “o‘rgatish” emas, “rivojlantirish” jarayonidir.

8. Tolerantlik va ijtimoiy integratsiya tamoyili. Inklyuziv ta’lim jamiyatda ijtimoiy birdamlik va bag‘rikenglikni shakllantirishga xizmat qiladi. Tolerantlik tamoyili:

- farqlilikni tabiiy qadriyat sifatida qabul qilish;

- turli ehtiyojli bolalar bilan birgalikda o‘rganishni ijobiy tajriba sifatida ko‘rish;

- o‘quvchilarni insonlar o‘rtasidagi farqlarni hurmat qilishga o‘rgatish. Bu tamoyil orqali inklyuziv ta’lim shaxsiy darajadagi hamdardlikni ijtimoiy darajadagi solidarlikka aylantiradi.



“KELAJAK TEKNOLOGIYALARI VA SUN’IY INTELLEKT”
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

9. Raqamli ochiqlik va innovatsionlik tamoyili. Zamonaviy inklyuziv ta’lim raqamli texnologiyalarsiz tasavvur etilmaydi.

- Elektron resurslar, onlayn platformalar, virtual laboratoriyalar orqali ta’lim imkoniyatlari kengayadi;
- alohida ta’lim ehtiyojlari bo’lgan o’quvchilar uchun sun’iy intellekt asosida moslashtirilgan dasturlar qo’llaniladi;
- Ta’lim muhitida “ochiqlik” – ma’lumot va resurslarning barcha uchun teng taqsimlanishini anglatadi. Bu tamoyil “Digital Inclusion” konsepsiyasiga asoslanadi — ya’ni raqamli texnologiyalar yordamida ijtimoiy tenglikni ta’minlash.

10. Uzlusizlik va barqarorlik tamoyili. Inklyuziv ta’lim bir martalik loyiha emas, balki uzlusiz rivojlanish jarayonidir.

- Ta’limning barcha bosqichlarida (maktabgacha, umumiy, oliy, kasbiy) inklyuzivlik prinsiplari davomiy bo’lishi kerak;
- O’qituvchilar malakasini oshirish, o’quv dasturlarini yangilash jarayoni muntazam amalga oshiriladi;

Xulosa. Davlat siyosatida inklyuziv ta’limni barqaror qo’llab-quvvatlash mexanizmlari ishlab chiqiladi. Inklyuziv ta’limning tamoyillari-bu insonni markazga qo’ygan, tenglik va hamkorlikka asoslangan yangi pedagogik madaniyatdir. U ta’limni nafaqat bilish, balki insoniylik, bag’rikenglik va empatiyani tarbiyalovchi tizimga aylantiradi. Demak, inklyuziv ta’lim tamoyillari quyidagi umumiy g’oyani ifodalaydi: “Hech kim chetda qolmasin, har bir inson o’z imkoniyatiga ko’ra o’rganish va rivojlanish huquqiga ega.” Inklyuziv ta’lim zamonaviy ta’lim tizimining ajralmas qismi bo’lib, uning samaradorligi ilmiy asoslangan boshqaruv tizimiga bog’liq ekanligi asoslanadi.

FOYDALANILGAN ADABIYOTLAR RO‘YXATI

1. Mirziyoyev Sh.M. Yangi O‘zbekiston-inson qadrini ulug‘lash mamlakati.-Toshkent: “O‘zbekiston” NMIU, 2022. – 432 b.



“KELAJAK TEXNOLOGIYALARI VA SUN’IY INTELLEKT”
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

2. O‘zbekiston Respublikasining “Ta’lim to‘g‘risida”gi Qonuni. – Toshkent: Adliya vazirligi nashri, 2020. – № ZRU–637.
3. O‘zbekiston Respublikasida inklyuziv ta’limni rivojlantirish konsepsiyasi (2020–2025 yillar). – Toshkent: Oliy va o‘rta maxsus ta’lim vazirligi, 2020. – 45 b.
4. Amonov U., Kenjayeva M. Pedagogik integratsiya va individual yondashuvning metodologik asoslari. – Toshkent: TDPU nashriyoti, 2021. – 210 b.
5. Rasulov I., Jalilova G. Inklyuziv ta’lim psixologiyasi. – Toshkent: “Fan va texnologiya”, 2020. – 185 b.
6. UNESCO. Policy Guidelines on Inclusion in Education. – Paris: UNESCO Publishing, 2009. – 48 p.
7. Booth, T., Ainscow, M. Index for Inclusion: Developing Learning and Participation in Schools. – Bristol: Centre for Studies on Inclusive Education (CSIE), 2016. – 128 p.
8. Florian, L., Black-Hawkins, K. Exploring Inclusive Pedagogy. // *British Educational Research Journal*. – 2011. – Vol. 37, № 5. – P. 813–828.
9. Slee, R. The Irregular School: Exclusion, Schooling and Inclusive Education. – London: Routledge, 2011. – 240 p.
10. Avloniy A. Turkiy guliston yoxud axloq. -Toshkent: “Ma’naviyat”, 2018.-256 b.
11. D.H.Qudratova., Inklyuziv ta’lim muhitida individual yondashuv strategiyalari va pedagogik qo‘llab-quvvatlash modeli (*monografiya*). -Buxoro. 2025 y.-20 b.



Development of an Intelligent Personalized Clothing Design System Based on Machine Learning Methods and Digital Anthropometry

Karimberdiyeva Mohinur Sherzod qizi

Researcher

ORCID: 0009-0005-5431-6283

E-mail: Mokhinurr6@gmail.com

Abstract

This article examines modern approaches to the development of an intelligent personalized clothing design system based on machine learning methods and digital anthropometry. It substantiates the relevance of integrating artificial intelligence into clothing design processes while taking into account the individual anthropometric characteristics of users. The main stages of the intelligent system's operation are presented, and the advantages of applying digital anthropometry and machine learning algorithms to improve design accuracy, reduce production costs, and enhance customer satisfaction are discussed.

Keywords

artificial intelligence, machine learning, digital anthropometry, personalized clothing design, 3D scanning, digital technologies, light industry.

**Разработка интеллектуальной системы персонализированного
проектирования одежды на основе методов машинного обучения и
цифровой антропометрии**

Karimberdiyeva Mohinur Sherzod qizi

Researcher

ORCID: 0009-0005-5431-6283;

e-mail: Mokhinurr6@gmail.com



“KELAJAK TEKNOLOGIYALARI VA SUN’IY INTELLEKT”
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

Аннотация. В статье рассматриваются современные подходы к разработке интеллектуальной системы персонализированного проектирования одежды, основанной на методах машинного обучения и цифровой антропометрии. Обоснована актуальность внедрения искусственного интеллекта в процессы моделирования одежды с учетом индивидуальных антропометрических параметров человека. Представлены основные этапы функционирования интеллектуальной системы, раскрыты преимущества применения цифровой антропометрии и алгоритмов машинного обучения для повышения точности проектирования, снижения производственных затрат и повышения удовлетворенности потребителей.

Ключевые слова: искусственный интеллект, машинное обучение, цифровая антропометрия, персонализированное проектирование одежды, 3D-сканирование, цифровые технологии, легкая промышленность.

Современная индустрия моды переживает этап глубокой цифровой трансформации, обусловленной широким внедрением технологий искусственного интеллекта, машинного обучения (Machine Learning) и цифровой антропометрии. Традиционные методы проектирования одежды ориентированы преимущественно на стандартные размерные признаки человека, что нередко приводит к снижению эргономичности изделий, увеличению производственных затрат и росту количества возвратов готовой продукции. В этих условиях особую актуальность приобретает разработка интеллектуальных систем персонализированного проектирования одежды, способных учитывать индивидуальные особенности телосложения каждого потребителя и автоматически формировать оптимальные конструктивные параметры изделия.[1]

Персонализированное проектирование представляет собой интеграцию современных цифровых технологий измерения человеческого тела, методов



"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

анализа больших данных (Big Data), алгоритмов машинного обучения и автоматизированных систем конструирования одежды (CAD/CAM). Основной целью подобных интеллектуальных систем является создание цифровой модели человека, позволяющей максимально точно определить антропометрические характеристики пользователя и на их основе сформировать индивидуальный цифровой шаблон будущего изделия. Такой подход существенно повышает качество посадки одежды, минимизирует количество примерок и способствует развитию концепции массовой кастомизации (Mass Customization).[2]

В последние годы особое внимание уделяется использованию технологий трехмерного сканирования тела человека. Современные 3D-сканеры позволяют за несколько секунд получить сотни антропометрических параметров, недоступных при традиционных измерениях. Полученные данные автоматически преобразуются в цифровую модель, которая служит исходной информационной базой для последующего машинного анализа. Благодаря высокой точности цифровая антропометрия значительно превосходит классические методы измерений и обеспечивает объективность получаемых результатов.[3]

Методы машинного обучения существенно расширяют возможности цифровой антропометрии. Алгоритмы искусственных нейронных сетей, Random Forest, Support Vector Machine, Gradient Boosting и глубокого обучения способны анализировать большие массивы антропометрических данных, выявлять скрытые закономерности между параметрами тела человека и автоматически прогнозировать оптимальные конструктивные решения при проектировании одежды. При накоплении новых данных интеллектуальная система самостоятельно совершенствует математические модели прогнозирования, постепенно повышая точность рекомендаций и качество готовых изделий.[4]



"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

Особую роль играют технологии компьютерного зрения (Computer Vision), позволяющие получать антропометрические данные не только посредством профессиональных 3D-сканеров, но и при помощи обычных мобильных устройств. Использование фотографий человека, выполненных с нескольких ракурсов, позволяет построить цифровой аватар пользователя и автоматически определить основные размерные характеристики. Подобные технологии значительно расширяют доступность персонализированного проектирования одежды и делают возможным их широкое применение в электронной коммерции.[5]

Интеллектуальная система персонализированного проектирования включает несколько взаимосвязанных функциональных модулей. На первом этапе осуществляется сбор антропометрических данных посредством цифрового сканирования либо компьютерного зрения. Затем производится предварительная обработка информации, устранение шумов и нормализация данных. Следующий этап предусматривает применение алгоритмов машинного обучения для классификации типов телосложения, прогнозирования параметров посадки изделия и автоматической генерации конструктивных лекал. Заключительный этап включает виртуальную примерку одежды, анализ качества посадки и корректировку цифровой модели изделия до получения оптимального результата.[6]

Важным преимуществом применения интеллектуальных технологий является возможность создания самообучающейся системы. После каждой новой примерки пользователь оценивает качество посадки одежды, а полученная обратная связь поступает в базу данных системы. Алгоритмы машинного обучения используют накопленный опыт для последующей корректировки математических моделей, благодаря чему точность рекомендаций постепенно





"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

возрастает. Такой механизм обеспечивает непрерывное совершенствование интеллектуальной платформы без необходимости полного перепрограммирования алгоритмов.[7]

Следует отметить, что широкое внедрение подобных систем сопровождается рядом научно-технических проблем. Среди них особое место занимают вопросы обеспечения конфиденциальности персональных антропометрических данных, стандартизации цифровых моделей человека, совместимости программного обеспечения различных производителей и высокой стоимости профессионального оборудования. Кроме того, важной задачей остается разработка универсальных алгоритмов, способных одинаково эффективно работать с различными возрастными, этническими и гендерными группами населения.[8]

Таким образом, интеграция методов машинного обучения и цифровой антропометрии формирует принципиально новую концепцию интеллектуального проектирования одежды. Использование самообучающихся алгоритмов искусственного интеллекта позволяет перейти от массового производства стандартных размеров к полностью персонализированному изготовлению изделий. В перспективе дальнейшее развитие подобных технологий будет способствовать повышению конкурентоспособности предприятий легкой промышленности, снижению производственных затрат, улучшению качества готовой продукции и формированию нового уровня цифровизации процессов проектирования одежды.[9]

Список использованных источников

- [1] Bishop C. M. *Pattern Recognition and Machine Learning*. — New York: Springer, 2006.
- [2] Goodfellow I., Bengio Y., Courville A. *Deep Learning*. — Cambridge: MIT Press, 2016.



"KELAJAK TEXNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

[3] Ashdown S. *Sizing in Clothing: Developing Effective Sizing Systems for Ready-to-Wear Clothing*. — Cambridge: Woodhead Publishing, 2007.

[4] Russell S., Norvig P. *Artificial Intelligence: A Modern Approach*. 4th ed. — Pearson, 2021.

[5] Guo Y., et al. Three-dimensional body scanning technologies in apparel engineering // *Textile Research Journal*. 2022.

[6] Beazley A., Bond T. *Computer-Aided Pattern Design and Product Development*. — Oxford: Blackwell Publishing.

[7] Witten I., Frank E., Hall M. *Data Mining: Practical Machine Learning Tools and Techniques*. — Morgan Kaufmann, 2017.

[8] ISO 20685-1:2018. *3-D scanning methodologies for internationally compatible anthropometric databases*. — Geneva: ISO.

[9] Tao F., Qi Q., Liu A., Kusiak A. Data-driven smart manufacturing // *Journal of Manufacturing Systems*. 2018.



Methodology of working with texts based on pictures and illustrations

Yusupova Umida Zayniddin qizi

Student, Andijan State Pedagogical Institute

Abstract:

This article discusses the methodology of teaching texts through pictures and illustrations in primary school reading lessons. It analyzes how visual materials help students understand text content, enrich imagination, develop logical and creative thinking, and increase motivation to read. The paper also highlights the effectiveness of activities such as question-and-answer tasks, storytelling based on illustrations, sequencing events, and creative exercises in improving text comprehension.

Keywords

pictures, illustrations, text-based learning, reading lessons, reading literacy, visual learning, creative thinking, interactive methods.

Rasm va ilustratsiyalar asosida matn ustida ishlash metodikasi.

Andijon davlat pedagogika inisituti talbasi

Yusupova Umida Zayniddin qizi

Annotatsiya: Ushbu maqolada boshlang'ich sinf o'qish darslarida rasm va ilustratsiyalar asosida matn ustida ishlash metodikasi yoritilgan. Rasimli materiallardan foydalanish orqali o'quvchilarning matn mazmunini anglash, tasavvurini boyitish, mantiqiy va ijodiy fikrlashini rivojlantirish hamda o'qishga bo'lgan qiziqishini oshirish yo'llari tahlil qilingan. Shuningdek, ilustratsiyalar asosida savol-javob, hikoya tuzish, voqealarni ketma-ketlikda tiklash va ijodiy topshiriqlarni tashkil etishning ta'lim samaradorligiga ta'siri asoslab berilgan.

Аннотация: В статье рассматривается методика работы с текстом на основе рисунков и иллюстраций на уроках чтения в начальных классах. Проанализированы возможности использования наглядных материалов для





"KELAJAK TEKNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

формирования понимания содержания текста, развития воображения, логического и творческого мышления, а также повышения интереса учащихся к чтению. Особое внимание уделено вопросам организации беседы по иллюстрациям, составления рассказов, восстановления последовательности событий и выполнения творческих заданий.

Kalit soʻzlar: rasm, ilustratsiya, matn ustida ishlash, oʻqish darsi, oʻqish savodxonligi, vizual taʼlim, ijodiy fikrlash, interfaol metodlar.

Ключевые слова: рисунок, иллюстрация, работа с текстом, урок чтения, читательская грамотность, визуальное обучение, творческое мышление, интерактивные методы.

Kirish

Boshlangʻich taʼlimda oʻqish darslarining asosiy maqsadi oʻquvchilarda ongli oʻqish, matn mazmunini toʻgʻri anglash va oʻqilgan material asosida mustaqil fikr yuritish koʻnikmalarini shakllantirishdan iborat. Bu jarayonda koʻrgazmalilik tamoyili muhim oʻrin tutadi. Ayniqsa, rasm va ilustratsiyalardan foydalanish oʻquvchilarning matnni osonroq tushunishiga, voqea-hodisalarni tasavvur qilishiga hamda matn mazmunini chuqurroq oʻzlashtirishiga yordam beradi. Vizual materiallar kichik yoshdagi oʻquvchilarning psixologik xususiyatlariga mos boʻlib, ularning diqqatini jalb qiladi, darsga qiziqishini oshiradi va faol ishtirok etishga undaydi.

Bugungi kunda taʼlim jarayonida rasm va ilustratsiyalar nafaqat koʻrgazmali vosita, balki oʻquvchilarning oʻqish savodxonligini, nutqiy kompetensiyasini, mantiqiy va ijodiy fikrlashini rivojlantiruvchi samarali pedagogik vosita sifatida eʼtirof etilmoqda. Shu sababli boshlangʻich sinf oʻqituvchisi matn ustida ishlashda vizual materiallardan maqsadli va metodik jihatdan toʻgʻri foydalanishi zarur.

Rasm va ilustratsiyalar asosida matn ustida ishlash metodikasi



“KELAJAK TEKNOLOGIYALARI VA SUN’IY INTELLEKT”
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

Boshlang‘ich sinf o‘quvchilari uchun matnni tushunishda vizual idrok muhim ahamiyatga ega. Rasm va ilustratsiyalar matndagi voqealarni ko‘z oldiga keltirishga, qahramonlarni tasavvur qilishga va voqealar o‘rtasidagi bog‘liqlikni anglashga yordam beradi. Ayniqsa, badiiy matnlarni o‘rganishda sifatli ilustratsiyalar o‘quvchilarning matnga bo‘lgan qiziqishini oshirib, o‘qish jarayonini yanada mazmunli qiladi.

Matn bilan ishlashni tashkil etishda avvalo ilustratsiyalarni kuzatish va tahlil qilish tavsiya etiladi. O‘qituvchi o‘quvchilarga rasmni diqqat bilan kuzatishni, undagi qahramonlar, predmetlar, voqea joyi va harakatlarni aniqlashni taklif etadi. “Rasmda kimlar tasvirlangan?”, “Voqea qayerda sodir bo‘lmoqda?”, “Qahramonlarning kayfiyatini qanday baholaysiz?” kabi savollar orqali o‘quvchilarning kuzatuvchanligi va mantiqiy fikrlashi rivojlantiriladi. Rasm asosida **taxmin qilish metodi** ham samarali hisoblanadi. O‘quvchilarga matn o‘qilmasdan oldin ilustratsiya ko‘rsatiladi va ular rasm asosida matn mazmunini taxmin qiladilar. Bu usul bolalarning tasavvurini kengaytiradi, darsga qiziqishini kuchaytiradi hamda o‘qishga ichki motivatsiyani shakllantiradi. Matn o‘qilgach, taxminlar haqiqiy mazmun bilan taqqoslanadi va xatolar muhokama qilinadi.

Matnni o‘zlashtirishda **rasm asosida hikoya tuzish** metodi ham keng qo‘llaniladi. O‘quvchilar ilustratsiyaga qarab voqealarni izchil bayon qiladilar, qahramonlarning harakatlariga tavsif beradilar va o‘z tasavvurlari asosida hikoya yaratadilar. Bu metod o‘quvchilarning og‘zaki nutqini, lug‘at boyligini va fikrni mantiqiy bayon qilish ko‘nikmalarini rivojlantiradi.

Yana bir samarali usul – **rasmlar ketma-ketligi asosida voqealarni tiklash** metodidir. O‘quvchilarga bir nechta ilustratsiyalar aralash holda taqdim etiladi va ular voqealar ketma-ketligini aniqlaydilar. So‘ng ushbu ketma-ketlik asosida matnni qayta hikoya qiladilar yoki yangi matn tuzadilar. Bunday mashqlar o‘quvchilarda sabab-oqibat munosabatlarini anglash va izchil fikrlash ko‘nikmalarini shakllantiradi.



"KELAJAK TEXNOLOGIYALARI VA SUN'IY INTELLEKT"
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

Rasm va ilustratsiyalar ijodiy topshiriqlar bilan uyg'unlashtirilganda yanada yuqori natija beradi. Masalan, o'quvchilarga matnga yangi ilustratsiya chizish, qahramon obrazini tasvirlash, komiks yaratish yoki voqeaga mos yangi yakun rasmini tayyorlash vazifalari berilishi mumkin. Bu topshiriqlar o'quvchilarning tasviriy tafakkurini, estetik didini va ijodkorligini rivojlantiradi. Zamonaviy axborot-kommunikatsiya texnologiyalari rasm va ilustratsiyalar asosida ishlash imkoniyatlarini yanada kengaytirmoqda. Interaktiv doskalar, elektron darsliklar, animatsiyalar, multimediali taqdimotlar va raqamli ilustratsiyalar yordamida o'quvchilar matn mazmunini nafaqat o'qish, balki ko'rish va tahlil qilish orqali ham o'zlashtiradilar. Bu esa o'qish jarayonini qiziqarli va samarali tashkil etishga xizmat qiladi. O'qituvchi rasm va ilustratsiyalarni tanlashda ularning mazmuni matnga mos bo'lishiga, yosh xususiyatlariga javob berishiga, estetik jihatdan sifatli va tushunarli bo'lishiga e'tibor qaratishi lozim. Shuningdek, vizual materiallar o'quvchilarning mustaqil fikrlashi va ijodiy faoliyatini rag'batlantiradigan topshiriqlar bilan boyitilishi kerak. Umuman olganda, rasm va ilustratsiyalar asosida matn ustida ishlash metodikasi boshlang'ich sinf o'quvchilarining matnni tushunish kompetensiyasini rivojlantirish, o'qish savodxonligini oshirish, og'zaki va yozma nutqini boyitish hamda ijodiy fikrlashini shakllantirishda muhim o'rin tutadi. Mazkur metodlardan tizimli foydalanish darslarning samaradorligini oshiradi va o'quvchilarning kitobxonlik madaniyatini rivojlantirishga xizmat qiladi.

Foydalanilgan adabiyotlar

1. Mirziyoyev Sh.M. Yangi O'zbekiston taraqqiyot strategiyasi. – Toshkent: O'zbekiston, 2022. – 416 b.
2. O'zbekiston Respublikasi Maktabgacha va maktab ta'limi vazirligi. Boshlang'ich ta'lim fanlari bo'yicha Milliy o'quv dasturi. – Toshkent, 2022.
3. O'zbekiston Respublikasi Vazirlar Mahkamasining Umumiy o'rta ta'limning davlat ta'lim standarti. – Toshkent, 2022.





“KELAJAK TEXNOLOGIYALARI VA SUN’IY INTELLEKT”
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

4. G‘afforova T., Nurullayeva Sh. O‘qish metodikasi. – Toshkent: Fan va texnologiya, 2021.
5. Qosimova K., Matchonov S., G‘ulomova X., Yo‘ldosheva Sh., Sariyev Sh. Ona tili o‘qitish metodikasi. – Toshkent: Noshir, 2022.
6. Ro‘ziyeva D., Tolipov O‘., Usmonboyeva M. Pedagogik texnologiyalar va pedagogik mahorat. – Toshkent: Innovatsiya-Ziyo, 2019.
7. Ishmuhamedov R., Abduqodirov A., Pardaev A. Ta’limda innovatsion texnologiyalar. – Toshkent: Iste’dod, 2008.
8. Mayer R.E. Multimedia Learning. 3rd ed. – New York: Cambridge University Press, 2021.
9. Paivio A. Mind and Its Evolution: A Dual Coding Theoretical Approach. – Mahwah, NJ: Lawrence Erlbaum Associates, 2007.
10. OECD. PISA 2022 Assessment and Analytical Framework. – Paris: OECD Publishing, 2023.
11. PIRLS International Study Center. PIRLS 2021 Assessment Frameworks. – Amsterdam: IEA, 2021.
12. Bruner J.S. The Process of Education. – Cambridge, MA: Harvard University Press, 1960.
13. Vygotsky L.S. Mind in Society: The Development of Higher Psychological Processes. – Cambridge, MA: Harvard University Press, 1978.
14. UNESCO. Global Education Monitoring Report 2023: Technology in Education – A Tool on Whose Terms? – Paris: UNESCO, 2023.
15. □ Tomlinson C.A. How to Differentiate Instruction in Academically Diverse Classrooms. 3rd ed. – Alexandria, VA: ASCD, 2017.



“KELAJAK TEKNOLOGIYALARI VA SUN’IY INTELLEKT”
nomli respublika ilmiy-amaliy masofaviy konferensiyasi
VOLUME-1, ISSUE-4, 2026

TABLE OF CONTENTS | СОДЕРЖАНИЕ

1.	METHODOLOGICAL FOUNDATIONS FOR ORGANIZING ROBOTICS CLASSES IN PRESCHOOL EDUCATIONAL INSTITUTIONS Axmedova Gulrux	3-8
2.	TWO-ENERGY X-RAY ABSORBSIOMETRY RESULTS IN PATIENTS WITH TYPE 2 DIABETES WITH SARCOPENIA Yusupova Shakhnoza, Izatillaev Azizbek	9-17
3.	Predictive Modeling of Solar Photovoltaic Power Generation: A Comparative Evaluation of Machine Learning Algorithms Under Volatile Micro-Climatic Conditions Abdurakhimov Shohzod	18-24
4.	TECHNICAL AND ECONOMIC PROSPECTS OF RENEWABLE ENERGY SOURCES Berdiyev Usmon, Allanazarov Ravshan	25-34
5.	Stages of Transition to an Inclusive Model in Reforms to Develop Inclusive Education in Uzbekistan Aslonov Madamin	35-44
6.	Development of an Intelligent Personalized Clothing Design System Based on Machine Learning Methods and Digital Anthropometry Karimberdiyeva Mohinur	45-50
7.	Methodology of Working with Texts Based on Pictures and Illustrations Yusupova Umida	51-55

