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- 13.00.00 Pedagogika fanlari
- 13.00.01 Pedagogika nazariyasi. Pedagogik ta'limotlar tarixi
- 13.00.02 Ta'lim va tarbiya nazariyasi va metodikasi (sohalar bo'yicha)
- 13.00.03 Maxsus pedagogika
- 13.00.04 Jismoniy tarbiya va sport mashg'ulotlari nazariyasi va metodikasi
- 13.00.05 Kasb-hunar ta'limi nazariyasi va metodikasi
- 13.00.06 Elektron ta'lim nazariyasi va metodikasi (ta'lim sohaları va bosqichlari bo'yicha)
- 13.00.07 Ta'limda menejment
- 13.00.08 Maktabgacha ta'lim va tarbiya nazariyasi va metodikasi
- 13.00.09 Ijtimoiy pedagogika
- 07.00.00 Tarix fanlari
- 19.00.00 Psixologiya fanlari
- 01.00.00 Fizika-matematika fanlari
- 02.00.00 Kimyo fanlari
- 03.00.00 Biologiya fanlari
- 09.00.00 Falsafa fanlari
- 10.00.00 Filologiya fanlari
- 11.00.00 Geografiya fanlari

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MUNDARIJA

O'quvchilarni intellektual rivojlantirishning psixologik omillari.....	22
<i>Ashurov Ramzidin Ramazonovich</i>	
Maktabgacha ta'limda bolaning kitobxonlik madaniyatini shakllantirishda oila bilan ishlashning nazariy asoslari	27
<i>Jumanova Fatima Uralovna, Allaberganova Munisa Begimboy qizi</i>	
Maktabgacha ta'lim tizimida axborot-kommunikatsiya texnologiyalaridan samarali foydalanishning metodologik asoslari	32
<i>Jo'rayeva Nargiza Tairovna, Bekbergenova Yulduz Tanirbergen qizi</i>	
Faoliyatli yondashuv asosida maktabgacha 6-7 yoshli bolalarda nutqiy ko'nikmalarini rivojlantirish metodikasi	35
<i>Ziyodullayeva Mohirabonu Ikromjon qizi</i>	
Davlat ta'lim muassasalarida manfaatlar to'qnashuvini boshqarishning tashkiliy-huquqiy mexanizmlari ...	39
<i>Xaybatullaeva Sojidxon Ziyatullayevna</i>	
Umumta'lim maktablarida jismoniy tarbiya darslarining samaradorligini oshirishda integratsion yondashuv	42
<i>Kamoliddinov Mirzohid</i>	
Boshlang'ich sinf o'quvchilarining mantiqiy tafakkurini rivojlantirishda interfaol metodlarning samaradorligi	45
<i>Kamoliddinova Dilnoza Axmadilaxanovna</i>	
Bo'lajak tarbiyachilarda kreativ faollikni rivojlantirish mexanizmlari.....	48
<i>Nurjanova Rayxan Urazbaevna</i>	
Sinf biologiya fanini o'qitishda TIMSS topshiriqlardan foydalanish metodikasi va baholash mezonlari	52
<i>Xaitboyeva Dilorom Rustam qizi</i>	
Qandli diabet tashxisli bemorlarda shaxs tuzilmasining emotsional komponentlari	56
<i>Sadikova Umida Botirovna</i>	
Maktabgacha yoshdagi bolalar nutqini rivojlantirishda pedagogik diagnostikani amalga oshirishning natijaviyligi	60
<i>Maxmutazimova Yulduz Raxmatovna, Qodirova Shaxnoza Saidazim qizi</i>	
Kasbiy imij shakllanishida psixologik jihatlarning tafovutlari	64
<i>Aminova Dilnoza Orifjonovna</i>	
Maktabgacha ta'lim tashkilotlari direktorlarining jamoa bilan ishlash jarayonida yetakchilik kompetensiyalarini rivojlantirish	69
<i>Abdiyeva Fazilat Fayzulla qizi</i>	
Kichik maktab yoshidagi bolalar shaxsi rivojlanishida psixologik moslashuvning tipik xususiyatlari	73
<i>Mirsaitova Guzal Baxodirovna</i>	
Oliy ta'lim tizimida variativ modellastirish asosida talabalarning kreativ faoliyatini rivojlantirishda zamonaviy pedagogik texnologiyalarining qo'llanilishi	76
<i>Quvvatova Mohira Hikmatillayevna</i>	
Interfaol treninglar orqali o'qituvchilarning innovatsion fikrlashini rivojlantirish tajribasi	79
<i>Abdiyeva Shodiyona Yodgor qizi</i>	
Maktabgacha yoshdagi bolalarda milliy qadriyatlar asosida axloqiy tarbiyani shakllantirishning ahamiyati.....	82
<i>Zulayxo Nazarova, Qarshiboyeva Muxlisa Ismatullo qizi</i>	
Ijodiy qobiliyatni o'stirishda pedagogik mahorat va innovatsion metodlar	85
<i>Mutallibova Odinaxon Mirzaolimjon qizi</i>	
Umumiy o'rta ta'lim maktablarida olimpiadalarga tayyorlashda masalalar yechish texnologiyasi 11-sinf misolida	89
<i>Aslonov Xayrullo Shukrullo o'g'li</i>	



Bokschi qizlarni texnika taktikasini takomillashtirish.....	94
<i>Axmedov Latifjon G'ayrat o'g'li</i>	
Ixtisoslashtirilgan terminologiyaning asosiy lingvistik xususiyatlari	99
<i>Axmedova Dilnoza Anvarovna</i>	
Interfaol metodlar orqali zamonaviy darslarni tashkil etishning o'ziga xos tendensiyalari	102
<i>Bakirov Otabek Bo'ranovich</i>	
Boshqaruv psixologiyasi terminlarini tarjima qilishning metodologik muammolari	106
<i>D. J. Norboyeva</i>	
Raqamli transformatsiya sharoitida oliy ta'lim muassasalari talabalari ruhiyatiga virtual muhitning salbiy ta'siri	110
<i>Giyosov Ulug'bek Eshpulatovich, Turayeva Nigora Husniddin qizi</i>	
Hamshiralik ishida raqamli texnologiyalardan foydalanishning samaradorligi.....	113
<i>Rasulova Gulmira, Amonova Dildora, Abdurahmonov Aziz, Hakimova X. X.</i>	
Boshlang'ich sinf o'quvchilarida kognitiv qobiliyatlarni shakllantirishda zamonaviy pedagogik yondashuvlar	117
<i>Jumayev Xushboq Soatmumin o'g'li</i>	
Principles of Organising Autonomous Learning.....	121
<i>Khazratova Zukhra Mamaraimovna</i>	
Najot – ta'limda, najot-tarbiyada	124
<i>Mo'minova Manzura Mamasodiqjonovna</i>	
Educational Potential of Museum Pedagogy and Criteria for its Application in Developing Historical Thinking of Pre-Service History Teachers.....	127
<i>Niyozov Javlonbek</i>	
Landshaft dizayni vastasida bo'lajak maktabgacha ta'lim tashkilotlari tarbiyachilarining estetik va kreativ ko'nikmalarini rivojlantirish	131
<i>Radjapova Zuxra Tirkashevna</i>	
Abdulla Avloniy pedagogik merosida shaxs psixologiyasi masalalari.....	134
<i>S. O. Mamarasulov, D. A. Egamberdiyeva</i>	
TBL metodini qo'llash orqali o'quvchilarning madaniyati va ijtimoiy muloqot ko'nikmalarini rivojlantirish....	138
<i>Sodikova Oyshakhon Muxammadsodik</i>	
Pedagogik innovatsiyalarni boshqarishning nazariy-metodologik asoslari.....	142
<i>Soliqova Barno Sodiq qizi</i>	
Boshlang'ich ta'lim magistratura talabalarining ijodiy faolligini rivojlantirish shart-sharoitlari	146
<i>Yarmatov Shermo'min Rahmatovich</i>	
Формирование готовности родителей детей старшего дошкольного возраста к выполнению воспитательной функции в семье.....	149
<i>Атаджанова Сохиба Талиповна</i>	
Redjio pedagogik yondashuv asosida maktabgacha katta yoshdagi bolalarda mantiqiy fikrlash ko'nikmalarini shakllantirish pedagogik muammo sifatida	152
<i>Djamilova Nargiza Nuritdinovna, Otahonova Marjona</i>	
Talabalarda algoritmik kompetentlikni rivojlantirishning sun'iy intellekt va Big Data Analytics asosida o'quv faoliyatini real vaqt rejimida kuzatuvchi va boshqaruvchi konseptual modelni takomillashtirish.....	155
<i>Kayumova Nazokat Rashitovna</i>	
Raqamli ta'lim muhitida chet tili o'qituvchilari va talabalar o'rtasidagi interaktsiyaning pedagogik samaradorligi va innovatsion mexanizmlari	163
<i>Eshonqulova Umida Xolmirzayevna</i>	
MTTlarda nutqni rivojlantirishga doir mashg'ulotlarda interfaol usullardan foydalanish texnologiyasi	168
<i>To'laboyeva Iqbolaxon Olimjonovna</i>	
Ta'lim jarayonidagi konfliktlar.....	173
<i>Abulova Mohigul Komiljonzoda</i>	
Talabalarining bolalarda ijtimoiy moslashuvni shakllantirishga kasbiy tayyorgarligini takomillashtirish	176
<i>Inomova Mahliyo Yusuf qizi</i>	

Shaxs tuzilmasida ma'naviy intellekt: nazariy-metodologik tahlil va psixologik interpretatsiya	179
Mirxoliqova Charos Xabibullaevna	
18-20 yoshli belbog'li kurashchilarning musobaqa oldi jismoniy tayyorgarliklari	183
Muzafarov Muxammadali Maxsudovich	
Talabalarda mustaqil ta'lim topshiriqlaridan foydalanib kasbiy madaniyatini rivojlantirishga zamonaviy yondashuvlar (boshlang'ich ta'limda tarbiya fani misolida)	187
Yadgarova Surayyo	
Maktab o'quvchilariga pedagogik ta'sir ko'rsatishda o'quvchilarning individual xususiyatlarini hisobga olish	190
Yo'ldoshova Shahlo Shukurullo qizi	
Bo'lajak boshlang'ich sinf o'qituvchilarini ma'naviy-ma'rifiy faoliyatga tayyorgarligini rivojlantirishning nazariy tahlili	194
Yusupova Sanobar Odil qizi	
Типология научного текста: от жанровой классификации к дискурсивной модели	197
Бахтияр Катибжанович Саттаров	
Взаимодействие педагога и семьи в профилактике и преодолении стресса у детей дошкольного возраста	201
Г. С. Алиходжаева, Х. Рахимова	
Условия эффективности инклюзивного образования	206
Г. С. Алиходжаева, Л. О. Бекмуродова	
Педагогическая готовность к обучению в школе детей билингов	211
Г. С. Алиходжаева, Н. А. Ганиева	
Педагогические условия формирования эмоционального интеллекта у дошкольников	216
Джалилова Феруза Намазовна	
Milliy meros va musiqiy madaniyatning yosh avlod tarbiyasidagi o'rni	219
Zuhridin Azizov	
Госпитальная школа как пространство поддержки и развития ребёнка (на примере госпитальной школы при детской клиники Синсиннати, США)	222
Муминов Р. Р., Хакимова Н. Х., Набиева Г. Г.	
Интерактивные формы работы в процессе профориентации детей дошкольного возраста	227
Н. Т. Жураева, С. М. Ахмеджанова	
Samarali hamkorlikdagi faoliyatga tayyorlashga oid yondashuvlar	231
Hojiyeva Zulfiya O'ktamovna	
Поэтапное вовлечение детей с расстройствами аутистического спектра в дошкольное инклюзивное образование: комплексный анализ научно-теоретических и практических подходов	234
Сабина Рагимова Ровшан кызы, Айсель Масимова Арастун кызы	
Umumta'lim maktablarida fizika fanini o'qitish metodikasini rivojlantirishda sun'iy intellektdan foydalanishni boshqarishni takomillashtirish	245
Allaniyazova Bibigul Sarsenbay qizi	
Boshlang'ich sinflarda ona tili va o'qish savodxonligi darslariga kreativ fikrlash asosida tayyorlash	248
Botirova Jumagul Chori qizi	
Boshlang'ich sinflarda fanlarni o'qitish metodikasini rivojlantirishda sun'iy intellektdan foydalanishni boshqarishni takomillashtirish	254
Kaypova Gulnara Muratbaevna	
Umumta'lim maktablarida tabiiy-ilmiy savodxonlik ko'nikmalarining rivojlantirish masalalari	257
Davletova Hamida Xasan qizi	
Boshlang'ich sinf o'quvchilarini ma'naviy axloqiy ruhda tarbiyalashning psixologik jihatlari	261
Fayzullayev Ermat Majidovich, Ortiqova Mashxura	
Orkestr va ansamblarning fan sifatidagi o'rni va tarbiyaviy ahamiyati	265
Fayzullayev Ermat Majidovich	
Maktab fizika darslarida interaktiv dasturlar va simulyatorlardan foydalanish metodikasi	269
Xayriddinova Malikaxon Qodirxon qizi	



Musiqada midi musiqiy cholg'ularning raqamli interfeysi.....	274
<i>Omonov Xasanxon Sulaymonovich</i>	
Karyera o'sishida gender tafovutlarning ahamiyati.....	277
<i>Yulchiboyeva Nazokatxon Iqboljon qizi</i>	
Bo'lajak musiqa o'qituvchilarining kreativlik sifatlarini rivojlantirishga ta'sir etuvchi pedagogik omillar	283
<i>Omonov Xasanxon Sulaymonovich, Normuradova Nafisa Kuchkarovna</i>	
Maktabgacha yoshdagi bolalarning ekologik tarbiyasi – ijtimoiy pedagogik muammo sifatida	287
<i>Kasimova Dilrabo Baxadirovna, Marjona Atoyeva Ismat qizi</i>	
Ilk yoshdagi bolalar psixologiyasi va rivojlanish xususiyatlari.....	291
<i>Kayumova Nargiza Mirziyatovna, Ne'matjonova Gulzira Ne'matjon qizi</i>	
Jadid pedagogik tafakkurida "o'qituvchi" fenomeni.....	294
<i>Xushbokov Oybek Uralovich</i>	
Maktabga tayyorlov guruhi tarbiyalanuvchilarida savol berish malakalarini shakllantirish	296
<i>Erhanova Nasiba Absayitovna</i>	
Musiqiy ta'limda xalq va zamonaviy qo'shiqlar vositasida maktabgacha yoshdagi bolalarning etnomadaniy komponentlarni shakllantirish	298
<i>Qurbanova Muslima Shavkatbek qizi</i>	
Umumta'lim maktablari o'quvchilarida tadbirkorlik ko'nikmalarini tarkib toptirish metodikasi (biologiya fani misolida).....	300
<i>Akmalova Farida Dilmurod qizi</i>	
Maktabgacha ta'limda adaptiv ta'lim texnologiyalari yordamida bolalar ijodkorlik ko'nikmasini shakllantirish mazmuni.....	304
<i>To'xliboyeva Zuxra Abdumutal qizi</i>	
Maktabgacha yoshdagi iqtidorli bolalar bilan ishlashda ta'lim texnologiyasi	308
<i>Xudoyberdiyeva Durdona Baxodir qizi</i>	
Pedagogik-psixologik qarashlarda otaning oiladagi o'rni haqidagi tasavvurlarni shakllantirish dinamikasiga oid fikrlar talqini.....	311
<i>Karshiyeva Dilafuz Suyunovna, Maxamatova Munisa Mamirzo qizi</i>	
Boshlang'ich sinf o'quvchilariga ingliz tilini o'qitishning nazariy va amaliy asoslari	314
<i>Axmatqulova Maxfuza Shuhrat qizi</i>	
Integrativ yondashuv asosida bo'lajak o'qituvchilarda interpersonal intellekt ko'nikmalarini rivojlantirish ...	318
<i>G'ulomova Oychehra No'monjon qizi</i>	
Etnomadaniy qadriyatlarni integratsiyalashgan ta'lim jarayonida maktabgacha yoshdagi bolalarga singdirishning samarali yo'llari	321
<i>G'ulomxo'jayeva Mushtariy Elmurod qizi</i>	
Boshlang'ich sinf ona tili darslarida grafik organayzerlardan foydalanish	324
<i>Iroda Isroilova</i>	
Buxoro iqlimi va tabiiy resurslaridan samarali foydalanish: ekologik va fizik-geografik yondashuv	329
<i>Mardonova Saodat Muzaffarovna</i>	
Effective Traditional and Innovative Approaches in English Language Teaching: Evidence From EFL Classrooms	333
<i>Yuldoshev Khaydarbek</i>	
Boshlang'ich sinf o'quvchilarining lug'at boyligini rivojlantirishda lingvopedagogik yondashuvning nazariy-metodologik asoslari.....	336
<i>Allayarova Sojida Umirzakovna</i>	
Механизмы использования цифровых педагогических технологий для обеспечения непрерывности образовательного процесса учащихся начальных классов в условиях длительного лечения	339
<i>Турсунова Д. З., Холлиева Н. Х.</i>	
Maktabgacha ta'lim tashkilotlarida o'tkazilgan o'yin faoliyatlarini bolalar ovozi talaffuzining takomillashuviga ta'siri	342
<i>Kattaxo'jayeva Shaxlohon Bohodirovna</i>	

O'qituvchilar tayyorlashda pedagogik innovatsiyalar va milliy kontentni integratsiya qilish strategiyalari ...	344
<i>Rahmatova Feruza Qudrat qizi</i>	
Maktabgacha katta yoshdagi bolalarni maktab ta'limiga tayyorlash jarayonini tashkil etishda tizimli yondashuv	348
<i>Abdusamatova Nargiza Jamoliddinovna</i>	
Moliyaviy savodxonlik asoslarini shakllantirish uchun "Tejamkor bola" o'yinli ta'lim faoliyatini asosida ishlashni takomillashtirilish.....	352
<i>Rizayeva Munisxon Maxkamovna</i>	
Maktabgacha ta'lim tashkilotlarida byudjet hisobi standartlariga (BHS) muvofiq buxgalteriya hisobini tashkil qilish va yuritish tartib-qoidalari.....	356
<i>Boltayev Ahmad Rustamjonovich</i>	
Maktabgacha ta'lim tashkilotlari moliyaviy munosabatlarning huquqiy asoslari	359
<i>Boymuradov Normurod Abdusadikovich</i>	
Oliy ta'lim muassasalarida jismoniy tarbiya va sportni rivojlantirishning metodologik asoslari.....	362
<i>Ma'rufov Mansurbek Musajonovich, Xonimov Mirqosim Samatqul o'g'li</i>	
O'smirlarda liderlik xususiyatlarini rivojlantirishning ijtimoiy-psixologik xususiyatlari.....	367
<i>Salayeva Dilafuz Buranovna</i>	
Pedagog nutq madaniyatining milliy va umuminsoniy qadriyatlarga ta'siri.....	370
<i>Toshtemirova Nigina Normurod qizi</i>	
Новые методы обучения устному переводу студентов-переводчиков.....	373
<i>Уринбаева Дилдора Утепбергеновна</i>	
O'quvchilarda axborot iste'moli madaniyatini rivojlantirishning pedagogik tuzilmasi	376
<i>Muxammadiyev Baxtiyor Jurayevich</i>	
Boshlang'ich ta'limda o'quvchilarning o'qish savodxonligini xalqaro mezonlar asosida rivojlantirish yo'llari	380
<i>Axrоров Voris Yunusovich, Botirova Ozoda Nasir qizi</i>	
Ta'lim sifatini baholashda raqamli texnologiyalardan foydalanishning o'rni (oliy ta'lim misolida)	385
<i>Axrоров Voris Yunusovich, Boltayeva Jaxona Ulug'bek qizi</i>	
Umumta'lim maktablarida 7-sinf biologiya fanini o'qitishda virtual laboratoriyalardan foydalanishning ta'lim samaradorligiga ta'siri	389
<i>Turakulova Mehriniso Nuriddinovna, Ruziqulova Nilufar Abdumajidovna, Allanzarova Natalya Aleuatdinovna</i>	
Maktabgacha yoshdagi bolalarni maktabga tayyorlashning mavjud holati va rivojlantirish strategiyalari ...	393
<i>Mamadaliyeva Mumtozbegin</i>	
6–7 yoshli bolalarning bilim olishga faol qiziqishini rivojlantirish metodikasi	396
<i>Artikova Muhayyo Botiraliyevna, Abduxolisova Gulsanam O'ktambek qizi</i>	
The Main Peculiarities of Abbreviations in Modern English.....	399
<i>Absalomova Aziza Baxodir qizi</i>	
Autizmli bolalarni maktab ta'limiga tayyorlashda bir qator terapiya va metodlardan foydalanish	404
<i>Yoqubova Hurriyat Burxonovna</i>	
Boshlang'ich ta'limda o'yinlar, virtual reallik va geymifikatsiya orqali o'quvchilarning motivatsiyasini oshirish.....	407
<i>Xaitova Nazokat</i>	
Boshlang'ich sinf o'quvchilarining ijodiy ko'nikmalarini rivojlantirishda tabiiy materiallardan foydalanishning pedagogik usullari.....	411
<i>Rustamova Manzura Mirkamalovna, Qo'ziyeva Umriniso Muzaffar qizi</i>	
Bo'lajak muhandislarning loyihalash ko'nikmalarini klaster muhitida rivojlantirish modellari	415
<i>Eshonqulova Shafoat Ergashevna, Sherzod Eshonqulov</i>	
Maktabgacha ta'lim tashkilotini rivojlantirish strategiyalarini ishlab chiqish	420
<i>Ermatova Mamlakat Qadirkulovna</i>	
9-sinf o'quvchilarini kasbga yo'naltirishda iqtisodiy ko'nikmalarni shakllantirish pedagogik muammo sifatida.....	423
<i>Eliboyeva Lola Sulaymonovna</i>	



Texnologiya asosidagi ingliz tili o'qitish va o'quvchi mustaqilligi: farmatsevtika talabalari misolida	427
<i>Ikranova Shohsanam Ravshanboy qizi</i>	
Maqollar asosida ingliz tili o'qitishning lingvodidaktik asoslari (Afg'oniston dariy tilli maktablar misolida) ..	430
<i>Samadi Nooria</i>	
Loyihaga asoslangan ta'lim texnologiyasi orqali talabalarda ijtimoiy mas'uliyat kompetensiyasini rivojlantirish tadqiqi	434
<i>Jo'rayeva Zebiniso Yo'ldosheva</i>	
Boshlang'ich sinfda tabiiy fanlarni o'qitish samaradorligini oshirishda innovatsion va zamonaviy pedagogik texnologiyalardan foydalanish	440
<i>Yulchiyeva Zulfiya Baxodir qizi</i>	
Shaxsning individual intellektual rivojlanishi pedagogik muammo sifatida	444
<i>Ol'tiboyeva Kamola Sharofjon qizi</i>	
Boshlang'ich ta'limda o'yin texnologiyalaridan foydalanish orqali o'quvchilar qiziqishini aniqlash yo'llari ...	448
<i>Qalandarova Yulduz G'ayrat qizi</i>	
Проблемы физического воспитания студентов и пути их решения	454
<i>Ходжанов Азиз Рахимович</i>	
Maktabgacha katta yoshdagi bolalarda axloqiy qadriyatlarni shakllantirishda milliy ertaklardan foydalanish texnologiyasi	458
<i>Kayumova Nargiza Mirziyatovna</i>	
Jamiyatda sog'lom turmush tarzini tashkil qilishda jismoniy tarbiya va sport mutaxassislarining o'rni	461
<i>Dehqonova Mahmuda Ortiqovna</i>	
Yadro itqitish sport turida kuch tayyorgarligining biomexanik va funksional ahamiyati	466
<i>Djabbarov Axror Islomovich</i>	
Kompetensiyaviy yondashuv asosida bo'lajak boshlang'ich sinf o'qituvchilarining didaktik tayyorgarligini takomillashtirish	469
<i>Axmedova Laylo Baxtiyor qizi</i>	
Boshlang'ich sinf o'quvchilarida tayanch kompetensiyalarni rivojlantirishda shaxsga yo'naltirilgan strategiyalar	475
<i>Urazimbetova Aygul Aralbayevna</i>	
Eshitishda nuqsoni bo'lgan bolalar nutqini rivojlantirishda kompyuter texnologiyalarining pedagogik imkoniyatlari	482
<i>Kamolova Yulduzxon Ma'murjon qizi</i>	
Maktabgacha ta'lim tashkilotlarida ma'naviy-ma'rifiy ishlarni tashkil etishda ota-onalar bilan hamkorlikni amalga oshirish texnologiyasi	488
<i>Kasimova Dilrabo Baxadirovna, Jo'rabayeva Nozima Bekmurod qizi</i>	
Psixologik zo'ravonlik oqibatlarini bartaraf etishda psixokorreksion mexanizmlar	491
<i>Tursunpo'latova Zaxro Zafar qizi</i>	
Shifokorlar professional karerasi resurslari va ularning obyektiv ko'rsatkichlari o'rtasidagi bog'liqlikni o'rganish natijalari	496
<i>Arziqulov O'tkirbek Maxammatovich</i>	
Bolalarda maktabgacha ta'lim yoshidagi kommunikativ qobiliyatlarni rivojlantirishda ijodiy o'yinlarning o'rni	501
<i>Berdiyeva Umida G'oyibberdiyevna</i>	
Maktabgacha katta yoshdagi bolalarning neyropedagogik yondashuvlar asosida kognitiv rivojlantirishning mohiyati	505
<i>Aliyeva Odila Madamin qizi</i>	
Emotional Intelligence and Perceptive Ability: Keys to Pedagogical Success	508
<i>Abdurakhimov Shokhasim Abdurakhmonovich</i>	
Bo'lajak logopedlarni og'ir nutq nuqsonli bolalar bilan ishlashga tayyorlashning nazariy asoslari	511
<i>Achilova Sevara Djasirkulovna</i>	
Abdulla Avloniy pedagogik g'oyalarini zamonaviy boshlang'ich ta'lim bilan integratsiyalash	515
<i>Daliyeva Eliza Zokir qizi</i>	

Talabalarda ma'naviy-axloqiy sifatlarini rivojlantirishda Mahmud Qoshg'ariy merosidan foydalanish.....	519
<i>Eliboyeva Lola Sulaymonovna, Ravshanova Sarvinoz O'ktamjon qizi</i>	
Derivation and Nominalization in Medical Terminology: A Comparative Model of Term and Process Name Formation in English and Uzbek	523
<i>Gulnigor Yazdonkulova</i>	
Maktabgacha yoshdagi bolalarning nutq buzilishlarida pedagogik-psixologik korreksiya usullari hamda mexanizmlari.....	526
<i>Jo'rayeva Muattar Abdumajit qizi</i>	
Ta'lim sifatini boshqarishga tizimli yondashish hamda pedagogikada PDCA modelining ahamiyati	530
<i>Jumanazarova Gulloila Yoqubjanovna, Xolmatova Maftuna Turdimat qizi</i>	
Sun'iy intellekt asosidagi ta'lim vositalarining kimyo ta'limidagi o'rni.....	535
<i>Jumaniyazova Mahliyo Qahramonovna</i>	
Inklyuziv maktab sharoitida kichik maktab yoshidagi bolalarda ijtimoiy-perseptiv tajribani shakllantirish ...	539
<i>Karimova Zulfiya Abduraxmanovna</i>	
Sirdaryo viloyati toponimlarining shakllanish jarayonlari	543
<i>Kenjayeva Iroda Alisherovna</i>	
Maktabgacha yoshdagi bolalarni maktab ta'limiga tayyorlashda art texnologiyalardan foydalanishning nazariy-metodologik asoslari.....	546
<i>Mamatova Husnora Eshquvatovna</i>	
O'quvchi yoshlarning innovatsion fikrlashini rivojlantirish va uni amaliy faoliyat bilan integratsiyalash	550
<i>Mehmonova Nilufar Shuhratovna</i>	
Integrating Social-Emotional Learning in EFL Classrooms: Enhancing Language Proficiency and Emotional Intelligence.....	553
<i>Meylinorova Feruza Bakhtiyor kizi</i>	
Nodavlat ta'lim tashkilotlari pedagog-tarbiyachilarining malakasini oshirish mexanizmini takomillashtirish	559
<i>Muminova Nargiza Sabitdjanovna</i>	
TEACCH konsepsiyasi – autizm va kommunikativ buzilishlari bo'lgan bolalarni davolash va o'qitish dasturi	562
<i>Murodova Sarvigul Raxim qizi</i>	
Aksiologik yondashuvlar asosida bo'lajak pedagoglarda altruizm ko'nikmalarini shakllantirishning funksional modeli	566
<i>Norboyeva Moxigul Shavkat qizi</i>	
Maktabgacha ta'lim tashkilotlarida o'yin texnologiyalari asosida bolalarning shaxsiy va ijtimoiy kompetensiyalarini takomillashtirish	569
<i>Norqulova Ma'mura Husniddin qizi</i>	
Umumiy o'rta ta'lim maktablarining 6-sinfida o'qitiladigan "Tabiiy fanlar"dan mashg'ulotlarni tashkil etish metodikasi.....	574
<i>Qo'qonboyeva Shaxlo Rafikjonovna</i>	
The Intersection of Science and Pedagogy: The Teacher's Role in Professional Evolution	580
<i>Rahimberdiyev Rustam Abdunasirovich, Shukurova Madina</i>	
Maktabgacha katta guruhlarida STEAM texnologiyasi bilan tanishtirishning pedagogik-psixologik xususiyatlari	583
<i>Rakhimova Laylo Hamidjon qizi</i>	
Hamshiralik ishida raqamli texnologiyalardan foydalanishning samaradorligi.....	586
<i>Rasulova Gulmira, Amonova Dildora, Abdurahmonov Aziz, Hakimova X. X.</i>	
Kurashchilarda muvozanat (balance) va ko'tarib uloqtirish texnikasi o'rtasidagi bog'liqlik	590
<i>Shermatov Gulom Qaxxorovich</i>	
O'qituvchi shaxsining o'zini o'zi rivojlantirishida akmeologik pozitsiyaning o'rni.....	594
<i>Xaitov Abdukosim Abdulakim o'g'li</i>	
Lego-qurilish, konstruksiyalash, robototexnika – STEAM ta'lim moduli sifatida	596
<i>Xamroyeva Sitara Samadovna</i>	
Raqamli jamiyatda o'smir yoshdagi o'quvchilarning huquqiy axborot olish madaniyatini rivojlantirish mexanizmlari	599
<i>Xayrullayev Axror Aktam o'g'li</i>	



Maktabgacha ta'limda axborot kommunikatsiya texnologiyalari yordamida ta'limiy o'yinlarni loyihalash va joriy etish	602
<i>Xikmatova Moxinur Amir qizi</i>	
Boshlang'ich sinflarda tabiiy fanlar orqali kognitiv qobiliyatlarni rivojlantirish zamonaviy yechimlarini ishlab chiqish usullari	605
<i>Xolmo'minova Mohichehra Bahrom qizi</i>	
O'quvchilarning biologiyaga qiziqishini oshirishda innovatsion ta'lim metodlari	609
<i>Xudayberganova Madina Saotboy qizi, Abdiqodirov Murodxo'ja Alisher o'g'li, Nishanbayeva Arayim User qizi</i>	
Oliy ta'lim muassasalarida shug'ullanuvchi voleybolchi qizlarning musobaqa oldi jismoniy va psixologik tayyorgarligini takomillashtirish metodikasi	612
<i>Xudoynazarova Sayyora Ravshanovna</i>	
Maktabgacha ta'limda milliy qadriyatlar asosida bolalarni axloqiy tarbiyalash texnologiyalari	618
<i>Yo'ldoshboyeva Gulmira Xushnudovna</i>	
Umumta'lim maktab seksiyasi uzunlikka sakrovchilarining jismoniy rivojlanganlik darajasi	621
<i>Zokir Akramov O'tkir o'g'li</i>	
Perseptiv qobiliyat: o'qituvchining o'quvchini tushunish sa'nati	625
<i>Zokirov Mirzaraxim Abdaliyevich</i>	
Ожидания и потребности родителей как основа продвижения услуг дошкольного образовательного учреждения в Республике Узбекистан	628
<i>Ким Ирина Николаевна, Аббосхонова Зухра Баходир кизи</i>	
Экспериментальная деятельность – метод развития здоровьесберегающей компетентности у детей старшего дошкольного возраста	631
<i>Ким Ирина Николаевна, Алиходжаева Райхон Шавкат кизи</i>	
Подготовка детей-билингвов к школьному обучению: интеграция цифровых и традиционных педагогических методов	634
<i>Ким Ирина Николаевна, Умарова Шоиста Рустамовна</i>	
Zamonaviy ta'lim muhitida tarbiya tizimini takomillashtirishda interaktiv metodlarning o'rni	637
<i>Islamova Dilfuza Dilshodovna, Baymurotova Madina Baxodir qizi</i>	
Methodological Support of the Process of Developing Preschoolers' Cognitive Skills Through TRIZ (TIPS) in a Technology-Enhanced Learning Environment	641
<i>Gauxar Djanpeisova, Veronika Gorbunova</i>	
Innovative Approaches to Early Mathematics Education and Development in Preschool Children	646
<i>Gauxar Djanpeisova, Shaxodat Berdiyeva</i>	
Ta'lim jarayonida intensiv texnologiyalar asosida mantiqiy tafakkurni rivojlantirish metodikasi	650
<i>Radjabova Mohigul Alisherovna</i>	
O'quv jarayonida ongli mushohada ko'nikmasini rivojlantirishda savol-javob usulidan foydalanish asoslari	653
<i>Ro'zimetova Intizor Alimovna</i>	
Boshlang'ich sinf o'quvchilari yozuv malakalarini shakllantirishning psixolingvistik tasnifi	656
<i>Axmataliyev Murodjon Ulug'bek o'g'li, Xojimatova Shoxsanam Erkinjon qizi</i>	
Ta'limda axborot-kommunikatsiya texnologiyalarining o'qituvchi kompetensiyasiga ta'siri	659
<i>Azamatova Rayhona Bahromjon qizi</i>	
13-14 yoshli o'quvchilarda harakatli o'yinlar va zamonaviy futbol mashg'ulotlarini integratsiya qilishning pedagogik asoslari	662
<i>Babayev Anvarjon Axmedovich</i>	
Boshlang'ich sinf o'quvchilarida ijtimoiy kompetensiyalarni rivojlantirish (nazariya, amaliyot va natijalar) ...	666
<i>Berdiyev G'ayrat Ulaboyevich, A. N. Sadatova</i>	
Elektron portfoliolar asosida individual rivojlanishni monitoring qilishning diagnostik modeli	670
<i>Kopbayeva Baxtigul Ziyadinovna</i>	
Pedagogik atamalarining ta'lim jarayonidagi o'rni va ahamiyati	674
<i>Islomov Nurtoy Nomoz o'g'li</i>	
Abdulla Avloniyning axloqiy-ta'limiy qarashlari	678
<i>Abdullayev Muxammadimin Egamberdiyevich, Turg'unov Dostonbek Rustamjon o'g'li</i>	

Talabalarda ma'naviy-axloqiy ideallarni rivojlantirishning nazariy-metodologik asoslari	682
<i>Ziyotov Farrux Saodilla o'g'li</i>	
Nazorat qiluvchi pedagogik dasturiy vositalarni yaratishda sun'iy intellektning ahamiyati	686
<i>Ermonov Sherzod Ibrayim o'g'li</i>	
Kreativ yondashuv asosida bo'lajak muhandislarda sog'lom turmush madaniyatini rivojlantirishning muhim yo'nalishlari	690
<i>Ibragimova Aziza Avaz qizi</i>	
Oliy ta'limda dual ta'lim va malakaviy amaliyotni takomillashtirish ("musiqqa ta'limi" misolida)	694
<i>Raximov Nurillo Narzullayevich</i>	
Uzluksiz ta'lim tizimida musiqa san'atining shaxs ma'naviy-estetik tarbiyasidagi pedagogik ahamiyati	698
<i>Sattarov Alisher Alikul o'g'li</i>	
Boshlang'ich sinflarda multimediali mantiqiy masalalar orqali o'quv jarayonini faollashtirish	702
<i>Jamoldinova Dildora Alijon qizi</i>	
Ta'lim markazlarida o'quvchilarning nutq kompetensiyalarini rivojlantirish metodologiyasi	706
<i>Buriyeva Xumoraxon O'lmasboy qizi</i>	
Raqamli jamiyatda o'smir yoshdagi o'quvchilarning huquqiy axborot olish madaniyatini rivojlantirish mexanizmlari	710
<i>Xayrullayev Axror Aktam o'g'li</i>	
AI-грамотность будущих педагогов: компоненты, вызовы и педагогические стратегии этической интеграции искусственного интеллекта	713
<i>Наркабилова Г. П.</i>	
Роль психолого-педагогических факторов в формировании нравственного поведения дошкольников	718
<i>Рахматходжаева Ф. М.</i>	
Внедрение инновационных технологий в дошкольно-образовательном учреждении	721
<i>Садикова Шоиста Акбаровна</i>	
Para stol tennisi sportchilarida jismoniy tayyorgarlikni oshirish samaradorligi	726
<i>X. A. Usmonova</i>	
Systematic Approach to the Issues of Educational Calculation in General Secondary Schools	729
<i>Ajiniyazova Sholpan Saparniyazovna</i>	
Роль системного профессионального развития в формировании компетентности учителей английского языка: международные тенденции и практика Узбекистана	733
<i>Жамолитдинова Нилуфар Акрамжоновна</i>	
Boshlang'ich sinf tabiiy fan darslarida funksional savodxonlikni rivojlantirish usullari	738
<i>Xujamkulova Nafisa Ruzikulovna, Saidmudova Maftuna Alisher qizi, Hafizova Oydinoy Doniyor qizi, Xujamkulova Maqsuda Ruzikulovna</i>	
Ingliz tili darslarida Kahoot o'quv platformasidan samarali foydalanish	743
<i>Amankulov Shavkat Qudratovich</i>	
Bolalarning kognitiv qobiliyatlarini rivojlantirishda polisensor muloqot metodikasi	747
<i>Musratova Zilola Ulug'bekovna</i>	
Коммуникативные способности педагога – ключ к эффективному взаимодействию с учащимися	752
<i>Акрамова Л. Ю.</i>	
Искусственный интеллект в образовании: киберпедагогические стратегии развития критического мышления	756
<i>Сайфитдинов Исломбек Зоирович</i>	
Регион как фактор суицидального риска: от климата до культуры общения	761
<i>Султанова Амина Анваровна, Махсумова Зилола</i>	
Bo'lajak shifokorlarga anesteziologiya va reanimatologiya fanini o'qitishning nazariy asoslari	765
<i>Ismailov Oybek Abdurasulovich</i>	
Sun'iy intellekt (SI)ning kommunikativ kompetensiyani rivojlantirishdagi metodik ahamiyati	768
<i>Komilov Furqat Solijon o'g'li</i>	
Implementing Total Physical Response Techniques in Your Language Class	770
<i>Rakhmatova Madina Sobirovna</i>	



METHODOLOGICAL SUPPORT OF THE PROCESS OF DEVELOPING PRESCHOOLERS' COGNITIVE SKILLS THROUGH TRIZ (TIPS) IN A TECHNOLOGY-ENHANCED LEARNING ENVIRONMENT

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Abstract: The article substantiates the pedagogical potential of TRIZ (TIPS–Theory of Inventive Problem Solving) as a universal methodology for developing preschoolers' cognitive abilities through structured work with contradictions, resources, systems thinking, and imaginative transformation. The study modernizes classical TRIZ-based didactic games by integrating contemporary educational technologies, including AI-assisted teacher planning within ethical boundaries, learning analytics for formative monitoring, augmented reality (AR) for visualizing systems and functions, and digital storytelling tools to support children's creative expression. The proposed model is grounded in developmentally appropriate practice, equitable access, and child well-being, including screen-time hygiene, and aligns with national priorities for the modernization of preschool education. The article presents an applied toolkit of TRIZ-guided activities and a set of methodological recommendations for educators, methodologists, and administrators.

Key words: TRIZ; TIPS; preschool education; cognitive development; systems thinking; contradictions; inquiry-based learning; educational games; learning analytics; augmented reality; digital storytelling; AI in education.

Annotatsiya: Maqolada TRIZ (TIPS – Ixtirochilik masalalarini yechish nazariyasi) metodologiyasining maktabgacha yoshdagi bolalarning kognitiv qobiliyatlarini rivojlantirishdagi pedagogik salohiyati ilmiy jihatdan asoslab berilgan. Tadqiqotda qarama-qarshiliklar bilan ishlash, resurslarni aniqlash, tizimli fikrlash va tasavvuriy transformatsiyaga asoslangan klassik TRIZ-didaktik o'yinlar zamonaviy ta'lim texnologiyalari bilan boyitilgan. Jumladan, etik me'yorlarga asoslangan o'qituvchilar uchun sun'iy intellekt yordamida rejalashtirish, formatif monitoring uchun learning analytics, tizim va funksiyalarni vizualizatsiya qilishda kengaytirilgan reallik (AR), hamda bolalarning ijodiy faoliyatini qo'llab-quvvatlovchi raqamli hikoyalash vositalari taklif etiladi. Taklif etilgan model rivojlanishga mos pedagogik yondashuv, teng imkoniyatlar va bolaning farovonligi, jumladan ekran vaqti gigiyenasiga asoslanadi hamda maktabgacha ta'limni modernizatsiya qilish bo'yicha milliy ustuvor yo'nalishlarga mos keladi. Maqolada TRIZ asosidagi mashg'ulotlar majmuasi va pedagoglar, metodistlar hamda boshqaruv xodimlari uchun amaliy-metodik tavsiyalar keltirilgan.

Kalit so'zlar: TRIZ; TIPS; maktabgacha ta'lim; kognitiv rivojlanish; tizimli fikrlash; qarama-qarshiliklar; izlanishga asoslangan ta'lim; didaktik o'yinlar; learning analytics; kengaytirilgan reallik; raqamli hikoyalash; ta'limda sun'iy intellekt.

Аннотация: В статье научно обоснован педагогический потенциал методологии ТРИЗ (TIPS – теория решения изобретательских задач) как универсального средства развития когнитивных способностей детей дошкольного возраста. Исследование направлено на обновление классических дидактических игр на основе ТРИЗ посредством интеграции современных образовательных технологий, включая этически ориентированное планирование деятельности педагога с использованием искусственного интеллекта, learning analytics для формативного мониторинга, технологии дополненной реальности (AR) для визуализации систем и функций, а также цифровые средства сторителлинга, способствующие развитию творческого самовыражения детей. Предлагаемая модель основана на принципах возрастной адекватности, равного доступа и обеспечения благополучия ребёнка, включая соблюдение гигиены экранного времени, и соответствует национальным приоритетам модернизации системы дошкольного образования. В статье представлен прикладной инструментарий TRIZ-ориентированных заданий и методические рекомендации для педагогов, методистов и администраторов.

Ключевые слова: ТРИЗ; TIPS; дошкольное образование; когнитивное развитие; системное мышление; противоречия; исследовательское обучение; дидактические игры; learning analytics; дополненная реальность; цифровой сторителлинг; искусственный интеллект в образовании.

INTRODUCTION

Modern preschool education increasingly aims not only to transmit knowledge but also to cultivate thinking tools: the ability to compare, classify, infer, anticipate consequences, and generate alternatives. In the Republic of Uzbekistan, preschool development strategies through 2030 emphasize quality, accessibility, modernization, and professional capacity building, thereby creating a favorable policy framework for methodological innovation.

TRIZ (in English, often presented as TIPS) offers a coherent logic for nurturing thinking. Within this approach, children learn to (a) identify a problem situation, (b) detect contradictions, (c) search for resources, (d) construct and evaluate solutions, and (e) reflect on the effectiveness of the chosen strategy. Today, the relevance of TRIZ is further increasing because preschool education is increasingly supported by digital tools; however, digitalization must remain human-centered, safe, and pedagogically justified. Global guidance on generative AI emphasizes the need for ethical regulation, privacy protection, and age-appropriate use, positioning AI as an assistive instrument rather than a replacement for human teaching.

LITERATURE REVIEW

An analysis of scholarly and methodological sources on developing preschoolers' cognitive abilities through TRIZ (TIPS) reveals a shared conclusion across contemporary research and policy documents: the educational impact of technology depends less on "digitalization itself" and more on purposeful didactic design, developmental appropriateness, the mediating role of the teacher, and the safety of the learning environment.

- 1. TRIZ (TIPS) as a methodology for developing preschool thinking.** In pedagogical adaptations of TRIZ for early childhood education, TRIZ is interpreted not as a set of isolated techniques but as a coherent logic of thinking actions. These actions include identifying a problem situation, searching for resources, working with contradictions, imagining an Ideal Final Result (IFR), and viewing objects through systems thinking (system–subsystem–supersystem). This methodological framework supports the transition from spontaneous trial-and-error behavior to structured solution generation, which is directly associated with key cognitive outcomes in preschool age, such as comparison, classification, causal reasoning, flexibility, and creative initiative.
- 2. Current trends in educational technologies for early childhood education.** The reviewed literature on digital transformation in education increasingly prioritizes technologies that strengthen:
 - personalization and formative assessment (e.g., observation-based monitoring and basic learning analytics);
 - the role of the child as a creator (digital storytelling, making, and modeling) rather than a passive consumer of content;
 - the "visibility of thinking" through visualization tools that help children externalize relationships, functions, and alternative solutions.

In this context, OECD publications emphasize how technological and societal changes reshape competency demands and underscore the importance of evidence-informed pedagogical decisions and the strategic implementation of innovation.



3. **Generative AI and methodological guidance of the process (the teacher's role).** Recent international guidance stresses that generative AI is most appropriate in early education as an instrument for professional teacher support—such as lesson design, differentiation, generating multiple task variants, and preparing prompts that guide children toward identifying resources and contradictions—rather than as a replacement for teacher–child interaction. UNESCO frameworks highlight ethical requirements, including transparency, privacy protection, age sensitivity, and human-centered governance. For the present study, this implies that “methodological guidance” includes clear rules defining the scope of AI assistance (planning and teacher preparation), quality control of generated materials, and safeguards for child protection and data privacy.
4. **AR and interactive media as “cognitive amplifiers” in preschool learning.** Contemporary studies on augmented reality (AR) and interactive tools indicate their potential to make abstract relations—such as properties, functions, categories, and system relationships—more concrete and manipulable for young children. When these tools are teacher-mediated and developmentally designed, AR can enhance engagement and support conceptual learning. Within a TRIZ-based approach, such tools can strengthen key cognitive operations, including “seeing the system,” identifying resources, comparing objects by multiple criteria, and testing alternative solutions in a safe exploratory format.
5. **Developmental appropriateness, well-being, and digital safety.** Position statements from NAEYC emphasize that technology use in early childhood education should be intentional, goal-oriented, interactive, and integrated with play and communication, without displacing movement, social interaction, or hands-on exploration. Health guidance from the World Health Organization similarly highlights the importance of limiting sedentary screen time for young children and prioritizing sleep, physical activity, and live interaction. In addition, UNICEF reports on childhood in the digital world underline the need for child-centered design, risk reduction, and the protection of children's rights and well-being in digital contexts.

Summary of the review. Overall, the literature supports the conceptual position of the article: TRIZ (TIPS) functions as the methodological core of cognitive development, while modern educational technologies—such as AR visualization, digital storytelling, basic learning analytics, and AI-assisted teacher planning—serve as an instrumental layer. The effectiveness of this layer depends on strong methodological guidance, teacher competence, and strict adherence to developmental and safety principles.

RESEARCH METHODOLOGY

TRIZ large volumes of inventive solutions were analyzed to identify recurring patterns in system evolution, and in pedagogical interpretation these ideas are adapted to the development of children's thinking. Within this framework, systems thinking enables any object or phenomenon to be examined as an interconnected system with elements, functions, and relationships. The resource approach encourages the child to search for “what can help” within a given situation, including materials, properties, the environment, time, and other people. Working with contradictions helps children understand that an effective solution often resolves opposing requirements rather than choosing only one side. The concept of the Ideal Final Result (IFR) guides children to imagine the best possible outcome and then move from imaginative representation to feasible steps. Heuristic reasoning supports structured thinking processes, emphasizing purposeful cognitive actions instead of random guessing. In the preschool context, TRIZ becomes most effective when embedded in play, dialogue, and exploration—forms that preserve children's intrinsic motivation and support natural cognitive engagement.

To meaningfully update TRIZ-based preschool practice, it is essential to select educational technologies that extend children's thinking rather than distract them. Contemporary pedagogical research highlights several directions as particularly valuable. AI-supported teaching, when used for adults rather than as a “shortcut” for children, allows educators to draft scenarios, differentiate tasks, prepare questions that guide children toward identifying contradictions and resources, and create variations of the same game for different developmental levels. International guidance consistently emphasizes human-centered use, privacy protection, transparency, and responsible age limits. Learning analytics for formative monitoring, such as digital observation checklists, simple dashboards, and evidence-based reflection tools, support teachers in identifying growth in comparison, classification, flexibility, persistence, and initiative. OECD materials underscore how data-informed and AI-supported tools can enhance pedagogical decision-making and personalization when applied responsibly.

Augmented reality (AR) and immersive visualization technologies are increasingly used in early childhood edutainment to enhance engagement and make abstract relations visible, including system–subsystem–super-system structures, functions, and hidden properties. Research on AR-based preschool applications reports positive user perceptions and potential learning benefits when design is developmentally appropriate and

teacher-mediated. Within a TRIZ-based approach, such tools strengthen key cognitive operations, including “seeing the system,” identifying available resources, comparing objects by multiple criteria, and testing alternative solutions in a safe exploratory format. Digital storytelling and the “child as creator” approach further support cognitive development by enabling children to externalize their thinking through short animations, stop-motion sequences, voice recordings, and interactive storyboards. These tools allow children to test “what-if” alternatives and revisit proposed solutions, aligning with TRIZ logic in which a story becomes a laboratory for working with contradictions and resources.

At the same time, safety and well-being remain central methodological considerations. International early childhood organizations emphasize the intentional, goal-driven use of interactive media within developmentally appropriate practice. Health guidance for children under 5 years of age highlights the importance of limiting sedentary screen time and prioritizing sleep, movement, and live interaction. Accordingly, the integration of TRIZ and technology should follow the principle of short, purposeful, active, and co-played engagement rather than passive viewing. Recent global discussions on children’s digital rights further stress that children should benefit from digital opportunities while being protected from risks, underscoring the importance of safe design and comprehensive digital literacy ecosystems.

The methodological model for TRIZ-based cognitive development in a digital preschool environment is grounded in several core principles. Developmental appropriateness ensures that tools support play, speech, imagination, and sensorimotor experience. Human-centered digitalization positions technology as a support for teacher decision-making rather than a replacement for interpersonal interaction. Equity and accessibility allow tasks to be implemented with low-technology alternatives when necessary. Formative monitoring focuses on observing thinking actions rather than solely evaluating “right answers.” Well-being and safety principles emphasize screen-time hygiene, privacy protection, and child safeguarding. The model is implemented through sequential stages, beginning with a diagnostic stage based on baseline observation of classification, verbal reasoning, flexibility, and initiative. The design stage involves selecting TRIZ tools—such as resources, contradictions, IFR, and the system operator—and aligning them with appropriate technologies, including AR cards, audio recorders, and digital storyboards. The implementation stage is organized around short cycles of “problem → alternatives → evaluation → reflection,” followed by a reflection stage in which teachers and children jointly summarize what was helpful, what was difficult, and what strategies can be tried next.

Updated TRIZ-based games and exercises illustrate the practical application of this methodological model. In the activity “The Mansion” (Little House), the goal is to develop analytical thinking, comparison, generalization, and systems vision by identifying common features and moving toward a supersystem. Classic materials include picture cards and a shared space, while optional technological extensions involve AR overlays that reveal hidden properties and interactive boards or tablet collages for regrouping objects by different criteria. TRIZ-focused guidance begins with identifying subsystem similarities and progresses toward functional and supersystem-level grouping. Formative assessment markers include the number of criteria used, flexibility of regrouping, and the quality of explanations. In the activity “Masha the Scatterbrain,” the focus is on attention, logical thinking, and resource-based problem solving. Children explore functional substitution through scenarios in which an item is missing, supported by voice notes, ethical teacher-only AI planning for scenario generation, and visual resource maps. IFR prompts encourage imagining self-functioning solutions, while contradiction-based tasks guide children to resolve opposing requirements through separation in space or time. In “Little Red Riding Hood,” transformation thinking and imaginative design are developed through tasks that require children to redesign characters based on object properties. Technology-enhanced formats include stop-motion mini-animations and digital storyboards, complemented by educational components that foster emotional regulation and empathy through reflective questioning.

ANALYSIS AND RESULTS

The expected cognitive outcomes of implementing TRIZ-based activities in a technology-enhanced preschool learning environment include a noticeable growth in children’s classification and comparison skills, which are reflected in their ability to group objects according to multiple criteria and to shift flexibly between different bases for comparison. Alongside this, improvements in verbal reasoning are observed, as children increasingly articulate why a particular solution works, justify their choices, and explain causal relationships in an age-appropriate manner. The approach also contributes to increased cognitive flexibility, manifested in the recognition that more than one valid solution or strategy may exist for the same problem situation. In addition, the development of initiative and productive persistence becomes evident, as children demonstrate a greater willingness to propose ideas independently, test alternatives, and continue problem-solving efforts despite initial difficulty.



The quality of these outcomes depends on several interrelated conditions of implementation. A central factor is the professional competence of the teacher in both TRIZ logic and the pedagogy of play, which enables the educator to guide children's thinking without suppressing initiative or creativity. Effective practice also requires that digital components be used in short, active episodes that are meaningfully integrated into movement-based and hands-on exploration, rather than functioning as isolated or passive activities. Ethical and secure digital practices are essential, including respect for privacy, the use of minimal and non-sensitive data, and consistent adult mediation during technology use. Furthermore, alignment with established health recommendations regarding sedentary screen time ensures that cognitive development is supported without compromising children's physical well-being, thereby maintaining a balanced and developmentally appropriate learning environment.

CONCLUSION AND RECOMMENDATIONS

TRIZ (TIPS) in preschool education functions as a “thinking scaffold” that helps children move from spontaneous guessing to the structured exploration of alternatives. When enriched with modern educational technologies—such as AI-assisted teacher planning, formative learning analytics, AR visualization, and digital storytelling—TRIZ-based practice can become more differentiated, observable, and engaging. However, its pedagogical value emerges only when technology is used in a developmentally appropriate, safe, and human-centered manner. This integrated approach supports the formation of a coherent and scientifically grounded worldview in children and creates a “success situation” in which one child's solution becomes a stimulus for the cognitive development and reflective thinking of others.

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- 13.00.00 Pedagogika fanlari
 - 13.00.01 Pedagogika nazariyasi. Pedagogik ta'limotlar tarixi
 - 13.00.02 Ta'lim va tarbiya nazariyasi va metodikasi (sohalar bo'yicha)
 - 13.00.03 Maxsus pedagogika
 - 13.00.04 Jismoniy tarbiya va sport mashg'ulotlari nazariyasi va metodikasi
 - 13.00.05 Kasb-hunar ta'limi nazariyasi va metodikasi
 - 13.00.06 Elektron ta'lim nazariyasi va metodikasi (ta'lim sohaları va bosqichlari bo'yicha)
 - 13.00.07 Ta'limda menejment
 - 13.00.08 Maktabgacha ta'lim va tarbiya nazariyasi va metodikasi
 - 13.00.09 Ijtimoiy pedagogika
 - 07.00.00 Tarix fanlari
 - 19.00.00 Psixologiya fanlari
 - 01.00.00 Fizika-matematika fanlari
 - 02.00.00 Kimyo fanlari
 - 03.00.00 Biologiya fanlari
 - 09.00.00 Falsafa fanlari
 - 10.00.00 Filologiya fanlari
 - 11.00.00 Geografiya fanlari



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