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PRINCIPLES OF INCLUSIVE EDUCATION AND THE INTERNATIONAL LEGAL FRAMEWORK FOR THE RIGHTS OF CHILDREN WITH DISABILITIES

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ABSTRACT
Uzbekistan has moved, within roughly five years, from having almost no legal category for inclusive education to running a national pilot that already covers several hundred schools. This article asks how that shift relates to the seven-decade sequence of international instruments that first articulated a right to inclusive schooling, and what comparison with more mature systems can tell reformers about where the Uzbek model is likely to strain next. Working from primary legal texts — UN declarations and conventions, UNESCO framework documents, and Uzbekistan's own laws and decrees since 2017 — alongside secondary academic and monitoring sources, the study builds an explicit, criterion-by-criterion comparison of Uzbekistan, Finland, and the United States across legal basis, individual-planning instruments, support structure, specialist staffing, and accountability mechanisms. The results indicate that Uzbek legislation has established the formal right to inclusion but has not yet built the individualised-planning and tiered-support machinery that sustains inclusion in the comparator systems, and that implementation remains concentrated in the early grades and in the capital. The discussion situates these findings within ongoing debates about the persistence of a defectological, medically framed vocabulary in national policy, and closes with concrete recommendations together with a proposed design for the empirical follow-up studies this literature-based review cannot itself provide.

ACCEPTED

15.07.26

Keywords: *inclusive education, children with disabilities, human rights, international convention, special educational needs, Uzbekistan, comparative education policy, social model of disability.*



1. Introduction

When a child is taught apart from other children, they learn both the subject on the timetable and the fact that they are being kept apart. International disability-rights law has spent the greater part of a century trying to unteach this second, inadvertent lesson. As in other post-Soviet countries, special preschools, boarding schools, and vocational institutes for children with disabilities were built in Uzbekistan on the premise that concentrated correctional expertise was worth the cost of isolation. Longitudinal data from the nations that abandoned that premise first suggest the trade was a poor one: children educated apart from their typically developing peers go on to have measurably more difficulty finding employment, building social networks, and using the everyday skills that mainstream education incidentally teaches. None of this is new. What has changed — and what this article sets out to document — is the density of binding and quasi-binding international commitments now pushing national systems

toward a different model, together with the fact that Uzbekistan has produced its own legislative response within the last five years after decades of comparative inertia.

The paper serves two related objectives. First, from the 1948 Universal Declaration of Human Rights to the 2015 Incheon Declaration, it reconstructs, in chronological sequence, the international legal documents that established the basis for inclusion. Second, it turns to Uzbekistan in particular, posing a more focused and practical question: given what sophisticated inclusive systems truly require — not just a right on paper, but individual-planning tools, tiered support, trained staff, and monitoring — which of those components has Uzbek policy already built, and which still need to be built?

2. Materials and Methods

That this is a normative-analytical, document-based study rather than an empirical one is a deliberate methodological decision rather than an oversight. The objective was to compare Uzbekistan's national record against a small number of carefully selected comparator systems using explicit, stated criteria rather than impressionistic description, and to establish, with a reasonable degree of completeness, what the relevant legislative provisions actually say. The primary sources comprised United Nations declarations and conventions, UNESCO framework documents, and Republic of Uzbekistan statutes, presidential decrees, and legislative resolutions adopted between 1948 and 2022. A document was added to the international set if the secondary literature examined below identified it as a pivotal moment in the evolution of the right to inclusive education; this produced eight documents spanning 1948 to 2015. To verify dates and the current status of each instrument (in force, amended, or superseded), national legal sources were located through the official National Database of Legislative Information and cross-checked against secondary reporting from UNICEF Uzbekistan, the OSCE, and independent Uzbek policy analysts. Secondary sources, cited independently of the core legal texts they support, were used strictly to confirm factual elements such as dates, article numbers, and enrolment statistics; they include peer-reviewed articles, reports from international organisations, and news reports from reputable outlets.

Three national systems were selected for direct comparison: the United States, as an example of a legally codified, individually enforceable model operating at large scale; Finland, as a frequently cited example of a well-resourced, high-autonomy tiered-support model; and Uzbekistan, as the study's subject. Two further Central Asian and post-socialist systems were examined in less detail as regional comparators. Rather than comparing these systems in narrative prose alone, five criteria were fixed in advance: legal basis for placement, individual-planning instrument, support structure, specialist personnel in mainstream schools, and monitoring or accountability mechanism. Each system was scored against each criterion using only information found in its own primary legal texts or, where no legal text was available, in the most reliable secondary source (Table 1).

For many years, special psychology and correctional pedagogy — also known as "defectology" — were the principal fields of Uzbek academia concerned with the education of children with impairments. Correctional-methodology courses still draw on Beltyukov's (1977) study of how sensory analysers interact during the perception and acquisition of oral speech under both normal and pathological conditions. Bogdanova (2002) extended this line into the psychology of hearing impairment, and the teacher-training textbooks of Mo'minova, Amirsaidova, and colleagues (2013) and of Po'latova, Nurmuxamedova, and Amirsaidova (2014) systematised special psychology and special pedagogy for use in educational institutions. In all four works, the main focus of intervention is the child's impairment rather than the environment. A competing account — the social model of disability — locates exclusion in an unaccommodating environment rather than in the individual; UNESCO's Global Education Monitoring Report, subtitled "Inclusion and Education: All Means All" (UNESCO, 2020), is widely credited with bringing this framing into the language of international policy. While Porsayeva (2025) has mapped the institutional and legislative requirements for inclusion at the higher-education level, Yusupov (2024) argues that existing policy texts in Uzbekistan combine the two vocabularies inconsistently, sometimes

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within a single document. What neither study offers — and what this article contributes — is a criterion-based comparison of Uzbekistan's emergent model with systems that have already resolved the tension these authors describe.

3. Results

The 1948 Universal Declaration of Human Rights contained the first universal statement of the right to education. This general principle was qualified by the 1975 Declaration on the Rights of Disabled Persons, which held that a person with a disability possesses dignity from birth and that a disability does not diminish any fundamental right, most notably the right to live as fully and as respectably as possible (Declaration on the Rights of Disabled Persons, 1975, Art. 3). Alongside race, sex, language, and origin, the 1989 Convention on the Rights of the Child included an explicit non-discrimination provision addressing disability (Art. 2), now binding on the almost universal group of states that have ratified it.

The operational language left implicit by the instruments of the 1970s and 1980s was supplied in the 1990s. Endorsed by 155 governments, the Jomtien World Declaration on Education for All (1990) demanded that schools be judged by how well they met educational needs rather than by the aptitudes of the students who happened to enrol. Four years later, the Salamanca Statement and Framework for Action (7–10 June 1994) went further, holding that regular schools are the most effective means of building inclusive, non-discriminatory communities (Salamanca Statement, 1994, para. 2) — an assertion that placed the onus of adaptation on the school rather than the child. Jomtien's commitments were reaffirmed under a new monitoring schedule in the 2000 Dakar Framework for Action, which stipulated that meeting Education for All targets required inclusive, safe, high-quality, and adequately resourced education (Dakar Framework for Action, 2000, pp. 20–21). This settled consensus in soft law was converted into a legally binding treaty obligation by the 2006 Convention on the Rights of Persons with Disabilities (CRPD). The Convention entered into force on 3 May 2008, and by the early 2020s more than 180 states had ratified it. Article 24 requires States Parties to guarantee an inclusive education system at every level and to provide the individualised support disabled learners need in order to benefit from it. Inclusive education was then incorporated into Sustainable Development Goal 4 through the 2015 Incheon Declaration, on the clear premise that no educational goal can be considered accomplished unless it is achieved for all students, disabled and non-disabled alike.

Uzbekistan's legislative record began later than most of the instruments above. After the 2009 signature had lain unratified for eight years, a 2017 presidential decree on strengthening state support for people with disabilities directed the relevant ministries to begin ratifying the CRPD — the first clear indication that ratification had become politically active. Article 20 of the amended Law "On Education" (No. O'RQ-637, 23 September 2020) defined inclusive education as equal access to education for all students "taking into account the diversity of special educational needs," and tasked the Cabinet of Ministers with giving effect to that definition. Three weeks later, a Concept for the Development of Inclusive Education in the Public Education System for 2020–2025, together with an implementing roadmap, was adopted by Presidential Decree No. UP-4860 (13 October 2020). In practice, this document has driven the pilot expansion detailed below.

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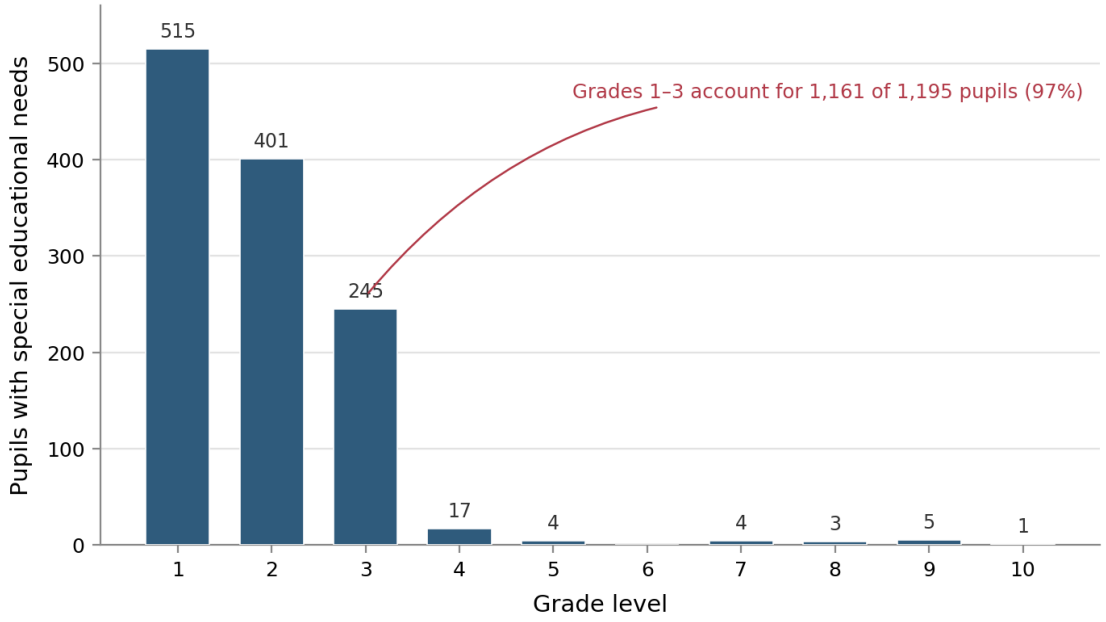


Figure 1. Enrolment of pupils with special educational needs across the 530 pilot schools, by grade level (2023–2024 school year; N = 1,195). Grades 1–3 account for 97% of all enrolled pupils. Source: authors' elaboration from official figures reported via UNICEF Uzbekistan.

On 7 June 2021, the CRPD was ratified, formally binding Uzbekistan to Article 24. Education and employment for people with disabilities were then listed as national priorities in the "New Uzbekistan Development Strategy for 2022–2026," after the two chambers of the Oliy Majlis translated that obligation into a National Action Plan for 2023–2025, adopted by joint resolution on 19 December 2022. Measured against these commitments, implementation has been real but limited. Under Decree UP-4860, 225 mainstream schools had opened to students with disabilities by September 2022; during the first half of the 2023–2024 school year that number rose to 530 schools, enrolling 1,195 students with special educational needs, including 449 girls. The breakdown by grade level is instructive (Figure 1): 515 of these children were in the first grade and 401 in the second, while only a handful were enrolled in the fifth grade or above. Inclusion in Uzbekistan is, in other words, still an entry-level phenomenon that has not yet permeated the school system — a pattern more consistent with a programme in the early stages of implementation than with a fully developed, systemic reform.

Table 1 sets out the five comparison criteria fixed in Section 2 and the corresponding position of Uzbekistan, Finland, the United States, and — in summary form — regional comparators that have followed a broadly similar post-socialist trajectory.

Table 1. Inclusive-education provision across Uzbekistan, Finland, the United States, and regional comparators, by five predefined criteria.

Criterion	Uzbekistan (2020–)	Finland	United States	Regional comparators*
Legal basis for placement	Law "On Education" (2020), Art. 20; Decree UP-4860	Basic Education Act, tiered-support amendments (2010)	Individuals with Disabilities Education Act (IDEA, 1990/2004)	Sectoral laws retaining special-institution priority

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Criterion	Uzbekistan (2020–)	Finland	United States	Regional comparators*
Individual planning instrument	Not yet mandated by law	Pedagogical assessment plan at Tier 2/3	Individualized Education Program (IEP), legally enforceable	Largely absent or advisory only
Support structure	Single-track mainstream placement	Three-tier: general → intensified → special support	Continuum of placements; "least restrictive environment"	Two-track: mainstream or special institution
Specialist personnel in mainstream schools	Tutor post not yet codified	Special-education teachers embedded in every tier	Related-service specialists mandated by IEP	Rare outside pilot sites
Monitoring / accountability	National Action Plan 2023–2025; no per-school reporting duty yet	Municipal-level pupil-welfare monitoring	Due-process hearings; federal compliance audits	Ministry-level aggregate statistics only
Scale of current coverage	530 schools / 1,195 pupils (2023–2024)	Nationwide, all grade levels	Nationwide, all grade levels	Pilot or donor-funded projects

** Regional comparators summarise published country reviews of post-socialist Central Asian and Eastern European systems rather than a single named country; the column is indicative rather than a fully coded case.*

Read across the rows, Table 1 highlights a specific gap rather than a general one: Uzbekistan has established the legal foundation for inclusion (row 1) but has not yet developed the individual-planning instrument, tiered support structure, or specialist staffing that give the Finnish and American systems their operational depth (rows 2–4). The monitoring row explains why this matters for the enrolment pattern described above. In the absence of a per-school reporting obligation, policymakers find it difficult to determine, grade by grade, where the pilot is succeeding and where it is stalling — which may help explain the concentration of enrolment in the first two grades. Unlike the Uzbekistan–Finland–United States comparison, the regional comparators draw on published country reviews of post-socialist Central Asian and Eastern European systems rather than on a single named country; they are included at a lower level of resolution and should be read as indicative rather than as a fourth fully coded case.

4. Discussion

The term "inclusive education" is applied both to the Finnish tiered-support model and to the considerably thinner practice of merely placing a disabled child in a regular classroom without additional accommodation. The contrast matters for understanding Uzbekistan's own reform. Earlier, "integrated" education moved children geographically without modifying the curricula, instructional strategies, or staffing around them; genuine inclusion, by contrast, requires changes to the school itself. The right is stated in inclusive terms in Article 20 of the 2020 Law "On Education," but Table 1 shows that the infrastructure needed to make the right work — individualised planning, tiered support, and embedded specialists — remains largely unbuilt. This critique is not unique to Uzbekistan; Finland and the United

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States also took decades to build their current apparatus, and in the United States the process involved considerable litigation.

The benefits of mature inclusive systems are well documented and multifaceted. Children with disabilities can remain in their own families and communities rather than in residential care; families are relieved of part of the practical and psychological burden of institutional placement; and, because inclusive pedagogy is more individualised by design, non-disabled classmates typically benefit as well. Early and successful social integration is associated over time with reduced lifetime reliance on external assistance — the outcome that most clearly justifies the initial expenditure on tiered support and specialist staffing. None of this is specific to Uzbekistan; it is the accumulated finding of the comparator systems examined here, and it is the argument for treating the gaps identified above as a priority rather than a footnote.

The comparison highlights four limitations. First, teacher preparation: differentiated, learner-centred instruction has not yet been incorporated into pre-service and in-service training at the scale the pilot requires, and there is as yet no legal category for the expert-tutor post that is embedded in mainstream schools in both Finland and the United States. Second, resources: access to facilities, transport, and learning materials remains uneven outside the pilot schools that national programmes have specifically targeted. Third, scale: extending inclusion through secondary and vocational education will require sustained investment well beyond the current pilot, as the grade-level concentration reported above indicates. Fourth, geography: while pedagogical institutions in outlying areas — such as the Nukus State Pedagogical Institute named after Ajiniyaz, in the Republic of Karakalpakstan — continue to train most of their graduates using the conventional defectology curriculum discussed in Section 2, reform activity and monitoring attention have concentrated in the capital and the larger regional centres. Regional teacher-training reform is arguably as important as any single national order, because the preparedness of newly qualified teachers ultimately sets the ceiling on how far inclusion can grow.

Taken together, the comparison in Table 1 and the four constraints above point to a specific, ordered set of next steps rather than a general call for “more resources”: (i) introduce a legally defined individual-planning instrument, loosely modelled on the American IEP or the Finnish pedagogical assessment plan but scaled to available resources; (ii) codify a specialist-tutor or learning-support role and fund it in mainstream schools, beginning with the 530 schools already in the pilot; (iii) implement teacher-training reform at regional educational institutions on the same schedule as the Tashkent-centred pilot, not after it; (iv) establish a per-school reporting obligation so that grade-by-grade enrolment and outcome data — like those compiled above from national aggregate figures — are regularly available at school level; and (v) continue the public-engagement and family-outreach initiatives already under way, since legal entitlement alone has proved insufficient in every comparator system examined here.

Because this is a document-based literature review that reports no survey, interview, or classroom-observation data of its own, its findings should be read as a mapping of what the legal and policy record shows rather than as an assessment of how the 530 pilot schools operate day to day. The enrolment figures reported above are the most recent officially reported data available at the time of writing and will need to be updated as later reporting periods become available. To move from this document-based mapping to an evidence base capable of testing the recommendations above, we propose a mixed-methods follow-up: a structured questionnaire on training background, perceived preparedness, and resource availability, administered to classroom teachers across a stratified sample of the 530 participating schools; semi-structured interviews with a purposive sample of parents of enrolled children, to capture experiences not visible in enrolment statistics; and a document audit of physical accessibility in a matched sample of participating and non-participating schools. Rather than relying on inferences from legal language alone, such a design would allow the comparative gaps identified in Table 1 to be tested against first-hand evidence from Uzbek classrooms.

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5. Conclusion

Inclusive education, properly built, keeps children with disabilities in schools close to home, alongside their typically developing peers, within a system flexible enough to differentiate instruction by need rather than sort children by category. International law took roughly seventy years to move from stating this as a general right (1948) to binding states to build it (2006) and to making its universality a condition of a broader development agenda (2015). Uzbekistan's own legislative response has compressed a comparable shift into five years — the 2020 Law "On Education," Decree UP-4860, CRPD ratification, and the 2023–2025 National Action Plan — and has already produced a measurable, if narrow, pilot covering 530 schools. The comparison developed here suggests that the immediate task is not to restate the right, which is now reasonably well established in law, but to build the individual-planning, tiered-support, specialist-staffing, and monitoring machinery that gives the right operational substance in Finland and the United States. Whether Uzbekistan's reform becomes a nationwide, all-grade system or remains an early-grade pilot will depend substantially on how quickly that machinery — rather than further legal declaration — is built, and on the kind of direct classroom evidence that the empirical follow-up proposed above is designed to provide.

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IN WHAT WAYS DOES EXPOSURE TO PEER LUXURY CONSUMPTION ON INSTAGRAM SHAPE THE EDUCATIONAL AND CAREER ASPIRATIONS OF TEENAGERS WITH PART-TIME JOBS?

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ABSTRACT

This paper examines how exposure to peer luxury posts on Instagram relates to the educational and career aspirations of teenagers who hold part-time jobs. It introduces the Aspiration Gap — the tension between a teenager's current life and the desirable lifestyles they see peers display online — as a proposed mechanism linking social-media exposure to decisions about education versus work. Drawing on an anonymous online survey of 200 adolescents aged 15–18 who work part-time and use Instagram, the study finds that the Aspiration Gap was widely reported and that three factors were associated with its direction: family background, patience (intertemporal discounting), and job type. Education leaning was more common among respondents from families that expected education, those classified as more patient, and those in skill-based jobs (about 70–85%), whereas work leaning was more common among respondents from families that needed money, those classified as more impatient, and those in labour-intensive jobs (about 75–80%). The findings extend the application of Social Comparison Theory and Conspicuous Consumption from emotional responses to reported life decisions. Because the design is cross-sectional and based on self-report, the results describe associations rather than causal effects; future work should test these patterns with experiments and longitudinal studies.

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Keywords: *Aspiration Gap; Instagram; social comparison; conspicuous consumption; intertemporal discounting; teenage part-time employment; education versus work; adolescent aspirations.*

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Introduction

A 17-year-old named Lola works fifteen hours a week at a local café. After her shift, she opens Instagram and sees a classmate posting a $99 meal at a fancy restaurant. Images like these fill her feed every day, and the scene is not unusual. Instagram has become a central part of teenage life, where carefully edited photos of seemingly perfect lives are the norm. At the same time, a growing number of teenagers hold part-time jobs in food service or family businesses — often their first experience of earning and spending their own money. They are also at an age when they must begin thinking about what comes after high school: college or full-time work.

Research has shown that upward social comparison on Instagram can make people feel worse about themselves. In a key study, Vogel and colleagues (2014) asked participants to view fabricated social-media profiles. Some profiles were designed to look highly successful — healthy habits, many likes and comments, and exciting activities — while others were less appealing. After only a few minutes, participants who viewed the successful profiles reported significantly lower self-esteem. Their mental state

was affected not by how much time they spent on social media, but by comparing themselves with someone who seemed better off. This finding matters for the present research because it shows that even brief exposure to a peer's idealised life can create a negative self-comparison. However, Vogel's study stopped at measuring feelings. We know less about whether such comparisons change what teenagers actually want out of life. For example, when teenagers with part-time jobs see luxury posts from peers, what — if anything — happens to their plans for education and work? This study builds on that gap by exploring how exposure to Instagram luxury posts relates to teenagers' educational and career aspirations.

By listening to teenagers themselves, this study explores what I call the Aspiration Gap — the tension teenagers feel between their current life (what they earn from a part-time job, their daily reality) and the luxurious lifestyle they see peers display on Instagram. When this gap feels large, it may push some teenagers toward wanting immediate money through work while motivating others to pursue education as a longer path to that lifestyle. Understanding this gap may help explain how Instagram luxury posts relate to teenagers' future choices about education and work. This leads to my central research question:

In what ways does exposure to peer luxury consumption on Instagram shape the educational and career aspirations of teenagers with part-time jobs?

Literature Review

To answer this question, I draw on two foundational theories. The first is Social Comparison Theory (Festinger, 1954). Festinger argued that people have a drive to evaluate themselves, and that they often do so by comparing themselves with others. When we compare ourselves with people who seem better off, we can feel inadequate. On Instagram, teenagers often see peers with luxury goods, which can create upward comparisons that may affect their self-perception.

The second theory is Conspicuous Consumption, first described by Thorstein Veblen in 1899 and revisited in modern scholarship (Trigg, 2001). Veblen observed that people buy and display luxury items to signal status and wealth rather than solely for practical use. On Instagram this is highly visible: many users post designer goods, exotic vacations, and other markers of success. Not all such posts are purely for status — they may also reflect self-expression, humour, or ordinary sharing — but for teenagers viewing them, the impression of wealth and success is often hard to ignore, and these images can become a benchmark for what a "good life" looks like.

The study also draws on intertemporal discounting, the tendency to value a smaller, immediate reward over a larger, delayed one (Frederick et al., 2002). Classic delay-of-gratification research (Mischel et al., 1989) found associations between children's willingness to wait for a larger later reward and subsequent outcomes; delay discounting has also been linked to educational attainment in adolescents (Lee et al., 2013; Golsteyn et al., 2014).

A growing body of recent work links these ideas to social media. Thoumrungroje (2018) showed that intensive social-media use is associated with materialism and heightened spending, while Lajunen and Olsen Haug (2023) found that Instagram use relates to lower self-esteem through social comparison. Studies focused on young people report similar patterns: exposure to influencers and peers on Instagram is associated with materialism (Dávila & Casabayó, 2025) and conspicuous consumption (Li et al., 2025; Yang et al., 2025), and with how adolescents build identity and status online (Noon, 2020; Butler, 2024). One experimental study links Instagram use to both higher materialism and students' learning motivation, suggesting that exposure to luxury imagery may relate directly to educational engagement (Otto & Thies, 2024). However, most of this research focuses on mental health or on emotional and consumption outcomes, and examines college students and adults. Few studies ask whether social media affects real-life decisions such as choosing between education and work, and fewer still focus on a group that is just beginning to earn and spend money while still deciding its future: teenagers with part-time jobs. This research addresses that gap.

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Methodology

Research design. This study used a cross-sectional online survey with a mainly quantitative design and one open-ended question. The aim was to examine associations between exposure to peer luxury posts on Instagram, the Aspiration Gap, and teenagers' aspirations toward education or work.

Participants. The sample consisted of 200 adolescents aged 15–18 who held part-time jobs and used Instagram. Responses were collected through an anonymous questionnaire distributed online using Google Forms. More responses were received than were analysed; test entries and incomplete submissions were removed, leaving 200 valid responses. Because the questionnaire was written in both Uzbek and English and used Uzbek currency (so'm) in one item, participants were predominantly based in Uzbekistan.

Instrument. The questionnaire contained fifteen items presented bilingually in Uzbek and English. The items measured: how often respondents saw peers post expensive items (Q1); whether they compared their own life with those posts (Q2); the emotions the posts evoked (Q3); how large they felt the gap was between their current life and the lifestyle shown (Q4, the Aspiration Gap); how much they desired that lifestyle (Q5); their family's expectations after school (Q6); whether their family currently needed the money they earned (Q7); intertemporal discounting through a monetary trade-off (Q8: 1,000,000 so'm today versus 2,000,000 so'm in one year) and through willingness to study four more years for a better career (Q9); the orientation their job encouraged (Q10); whether luxury posts had prompted them to work more hours at the expense of studying (Q11) or to study harder (Q12); their actual plan after school (Q13); the path they believed led fastest to the lifestyle they saw (Q14); and an optional open-ended reflection (Q15). Basic demographic details, including part-time job type, were also collected.

Classification of the three factors. Family background was derived from Q6 and Q7 (expects education / needs money / mixed). Patience (intertemporal discounting) was derived from Q8 and Q9: respondents who chose the larger delayed reward and agreed that further study was worth the wait were classified as patient, and those who chose the immediate reward were classified as impatient. Job type was taken from the demographic item and grouped into skill-based roles (for example, tutor, sports coach, retail or shop assistant, and cashier) and labour-intensive roles (for example, delivery, construction, and café or family-shop work). Each respondent's overall leaning — toward education, toward work, or being conflicted or unsure — was based primarily on their stated plan after school (Q13), supported by Q10, Q11, Q12, and Q14.

Ethics. Participation was anonymous and voluntary. No names, phone numbers, or other identifying information were collected, and respondents could stop at any time. Informed consent was obtained through an agreement item at the start of the survey ("I have read the conditions above and agree to participate"); for participants under 16, verbal parental consent was recommended. All responses were used only in aggregated form and solely for research purposes.

Analysis. Responses were summarised using descriptive statistics and cross-tabulated by family background, patience, and job type. The single open-ended item (Q15) was reviewed thematically to illustrate how respondents described the Aspiration Gap in their own words.

Findings

Among the 200 respondents, education- and work-leaning patterns varied by three factors: family background, patience (intertemporal discounting), and job type. The results are summarised in Figure 1 and Table 1.

Figure 1 shows the overall distribution of choices. Of the 200 teenagers, 92 (46%) leaned toward education, 78 (39%) leaned toward work, and 30 (15%) were conflicted or unsure. In other words, a slight majority still preferred education, but a substantial minority — nearly 40% — leaned toward immediate work.

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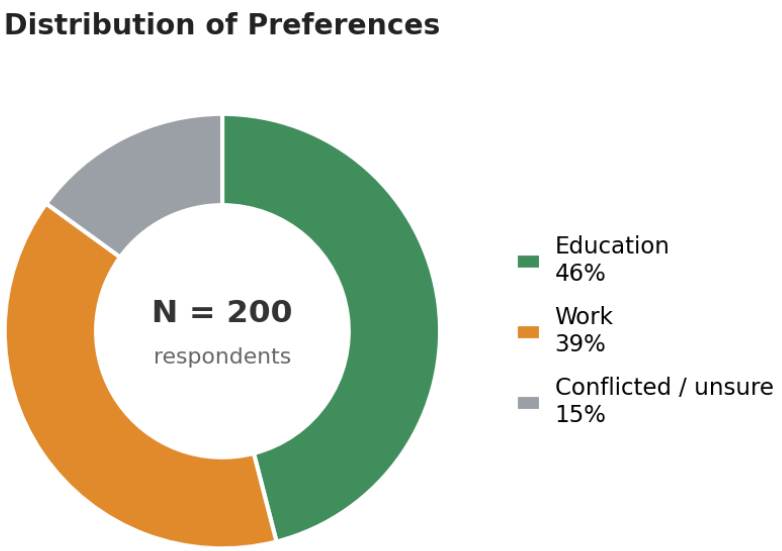


Figure 1. *Distribution of preferences among the 200 respondents: 46% leaned toward education, 39% toward work, and 15% were conflicted or unsure.*

Factor 1: Family background. Respondents from families that "expected education" leaned toward education more often (72%) than those from families that "needed money" (only 12% leaned toward education, while 80% leaned toward work).

Factor 2: Patience (intertemporal discounting). Respondents classified as patient were overwhelmingly education-leaning (85%), while impatient respondents were work-leaning (78%); the mixed group was roughly evenly split. This pattern is consistent with intertemporal discounting: respondents who valued future rewards more tended to lean toward education, while those who chose the immediate reward tended to lean toward work.

Factor 3: Job type. Respondents in skill-based jobs (such as tutor, sports coach, or retail assistant) leaned toward education (about 70% on average), whereas those in labour-intensive jobs (such as delivery, construction, or café or family-shop work) leaned toward work (about 75% on average). This suggests that the kind of part-time job a teenager holds may be associated with how they perceive the value of education relative to immediate income.

Table 1 summarises these subgroup patterns.

Subgroup	Dominant leaning	Approx. share
Family background		
Expects education	Education	72%
Needs money	Work	80% (12% education)
Patience (intertemporal discounting)		
Patient	Education	85%
Impatient	Work	78%
Mixed	Split	~50/50
Job type		
Skill-based (tutor, coach, retail)	Education	~70%
Labour-intensive (delivery, construction, café/family-shop)	Work	~75%

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Table 1. *Dominant leaning and approximate share by family background, patience level, and job type.*

The Aspiration Gap

Across the 200 responses, a pattern emerged: the tension between current and desired life — what I call the Aspiration Gap — was reflected in responses about future plans. In the open-ended responses, some teenagers described this tension directly. One representative response, paraphrased to protect anonymity, stated that the respondent saw peers with nice cars and clothes, wanted the same lifestyle, but was unsure whether to work now or attend college.

Discussion

These results are consistent with Social Comparison Theory and Conspicuous Consumption. Respondents reported comparing themselves with luxury posts and wanting the status items they saw. However, these theories alone do not explain why some leaned toward work and others toward education. That is where the Aspiration Gap and intertemporal discounting come in.

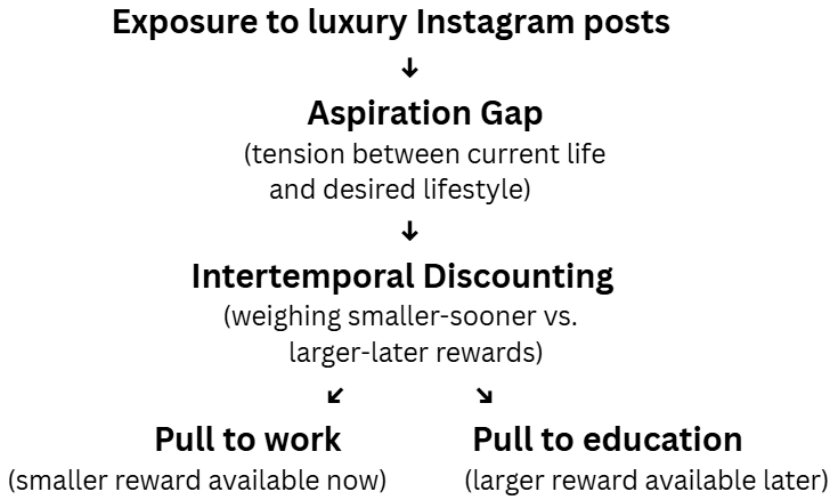


Figure 2. *Conceptual model of the Aspiration Gap and intertemporal discounting. Exposure to luxury posts may be associated with tension between current and desired life. This tension may relate to how respondents weigh a smaller-sooner reward against a larger-later one, corresponding to a pull toward either work or education.*

Family background, patience, and job type were associated with different orientations toward immediate and delayed rewards. Respondents classified as impatient, those from families needing money, and those in labour-intensive jobs tended to lean toward work — the smaller-sooner reward. Respondents classified as patient, those from families expecting education, and those in skill-based jobs tended to lean toward education — the larger-later reward.

These patterns are consistent with existing research on intertemporal discounting in adolescents (Mischel et al., 1989; Frederick et al., 2002; Lee et al., 2013; Golsteyn et al., 2014). The present study applies that work to examine how the Aspiration Gap reported in relation to Instagram luxury posts may be associated with intertemporal discounting in teenage career decisions.

Limitations

Several limitations should be kept in mind. Because the study is a cross-sectional survey based on self-report, it can identify associations but cannot establish causality: the findings do not prove that Instagram luxury posts directly cause teenagers to lean toward work or education. The sample was collected online and was largely self-selected, so it may not represent all working teenagers, and it was drawn mainly from one country. Self-reported attitudes may also differ from real behaviour. Finally, the measure of intertemporal discounting was based on two survey items rather than a full behavioural task.

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Future Directions

Future research could address these limitations in several ways. First, randomised experiments could test causality — for example, by exposing one group of teenagers to luxury Instagram posts and a control group to neutral content, then measuring discounting and career preferences immediately afterward. Second, cross-cultural replication is needed to examine how socioeconomic and cultural variables relate to the Aspiration Gap; extending the study to different national contexts could show whether these patterns hold across diverse populations. Third, larger and more diverse samples, together with control variables such as family income, academic performance, and parental education, would help disentangle the many factors shaping teenagers' educational and career aspirations. Emerging methods that use AI-generated synthetic respondents (Shrestha et al., 2024) may also complement survey research for generating hypotheses, though such simulations still require validation against real human data.

Conclusion

This study suggests that exposure to Instagram luxury posts is associated with how teenagers with part-time jobs think about their future. Across a survey of 200 working teenagers, the reported Aspiration Gap — the tension between current life and a desired lifestyle — varied with whether a teenager leaned toward work or education. Family background, patience (intertemporal discounting), and job type were also associated with the direction of that leaning. Work leaning was more common among impatient respondents, those from families that needed money, and those in labour-intensive jobs; education leaning was more common among patient respondents, those from families that expected education, and those in skill-based jobs.

These subgroup associations were broadly consistent with established theories of social comparison, conspicuous consumption, and intertemporal choice. The findings suggest that the Aspiration Gap is a reported tension associated with Instagram exposure and decisions about education and work.

The next step is to test these patterns in experimental settings. Studies that expose one group to luxury posts and another to neutral posts could test whether the Aspiration Gap causes shifts in career preferences. Even so, the findings suggest that Instagram luxury posts may be related not only to how teenagers feel but also to how they view the trade-off between earning today and investing in education. Parents and educators should be aware of this possibility, and future research should test it directly.

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FORMATION OF MORAL HYGIENE OF YOUNG PEOPLE IN THE CONDITIONS OF ARTIFICIAL INTELLIGENCE AND DIGITAL TECHNOLOGIES: A SOCIO-PHILOSOPHICAL ANALYSIS

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ABSTRACT
This article presents a socio-philosophical analysis of the formation of moral hygiene among young people in the context of artificial intelligence and digital technologies. The rapid expansion of the digital information environment and the widespread use of AI systems significantly influence young people’s worldview, value orientations, and moral behavior. In this context, the concept of moral hygiene is substantiated as a socio-philosophical category aimed at ensuring the moral and spiritual well-being of individuals, promoting critical thinking, improving media and information literacy, and developing moral immunity against manipulative information and destructive ideas. The research employs historical-logical, comparative, systemic, and socio-philosophical methods. The ethical ideas of Eastern and Western thinkers concerning moral purification, self-control, and personal development are analyzed in relation to the challenges of the digital age. As a result, a theoretical model for the formation of moral hygiene among young people in the digital society is proposed.

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Keywords: *artificial intelligence, digital technologies, digital society, moral hygiene, moral immunity, spiritual security, media and information literacy, critical thinking, youth, socio-philosophical analysis.*

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INTRODUCTION

The preservation of moral well-being is as important as the protection of physical health. Classical virtue ethics treats moral character as something cultivated through repeated judgment and habituation, while deontological ethics emphasizes inward responsibility and self-governance (Aristotle, 1999; Kant, 1998). Within Islamic ethical thought, moral purification and disciplined self-examination similarly function as preventive practices rather than responses applied only after misconduct has occurred (Al-Ghazali, 1995).

In a society increasingly shaped by artificial intelligence and digital technologies, young people encounter not only psychological and social pressures but also moral risks. Algorithmically selected information, disinformation, cyberbullying, anonymous communication, deepfakes, and automated persuasion can affect value formation and moral decision-making. Contemporary AI-ethics scholarship therefore emphasizes transparency, responsibility, non-maleficence, fairness, privacy, and human oversight (Floridi et al., 2018; Jobin et al., 2019; UNESCO, 2021a).

In this study, moral hygiene is defined as a preventive and reflective system through which individuals examine their actions, decisions, values, and motives, identify early risks of deviation from ethical norms, and apply self-corrective practices. This interpretation combines the philosophical traditions of care of the self, character formation, and moral self-discipline (Al-Ghazali, 1995; Aristotle, 1999; Foucault, 1986). It is intended as an analytical concept, not as a medical diagnosis.

Reflection is a central practical mechanism of moral hygiene. Reviewing one's digital behaviour, information-sharing habits, communication style, and decision-making can strengthen responsibility and self-regulation. Equally important is the capacity to verify AI-generated information, compare sources, recognize manipulation, and evaluate the possible consequences of sharing content. These abilities are central to media and information literacy and responsible digital citizenship (Choi, 2016; Richardson & Milovidov, 2019; UNESCO, 2021b). Thus, moral hygiene combines internal ethical self-regulation with critical participation in the digital environment.

LITERATURE REVIEW AND METHODOLOGY

The theoretical foundations of moral hygiene can be traced to Eastern and Western traditions of ethical self-cultivation. Al-Farabi links human happiness to knowledge, virtue, and the moral organization of society (Al-Farabi, 2001). Avicenna emphasizes rational inquiry and disciplined knowledge as means of resisting error (Avicenna, 2005). The ethical and didactic traditions represented by Yusuf Khass Hajib and Alisher Navoiy connect justice, knowledge, honesty, restraint, and social responsibility with the formation of the mature person (Dankoff, 1983; Navoiy, 1983). Al-Ghazali's account of disciplining the soul and the Naqshbandi tradition's emphasis on remembrance, vigilance, and self-control further illuminate practices of moral self-examination (Al-Ghazali, 1995; Weismann, 2007).

Western philosophy likewise gives sustained attention to moral responsibility and self-governance. Kant associates moral action with rational duty and autonomy (Kant, 1998), whereas Aristotle understands virtue as a stable disposition developed through practice (Aristotle, 1999). Foucault's account of care of the self highlights continuing ethical work upon the person (Foucault, 1986). Habermas places responsible, non-coercive communication at the centre of social legitimacy (Habermas, 1984), and Dewey treats moral education as an experiential and democratic process (Dewey, 1916). Bauman's analysis of liquid modernity is relevant to the instability and uncertainty that accompany contemporary moral choice (Bauman, 2000).

The study uses a dialectical approach, systemic analysis, historical-logical analysis, comparative interpretation, and socio-philosophical synthesis. The historical-logical method was applied to trace ideas of virtue, self-control, and moral purification; the comparative method was used to connect these traditions with contemporary theories of digital citizenship, media literacy, and AI ethics. Systemic analysis was then used to identify five interdependent components of moral hygiene: spiritual values, critical thinking, media and information culture, AI ethics, and moral self-control. Chart 1 summarizes the composition of the 33 verified sources used in the revised manuscript; it is a bibliographic description rather than an empirical result.

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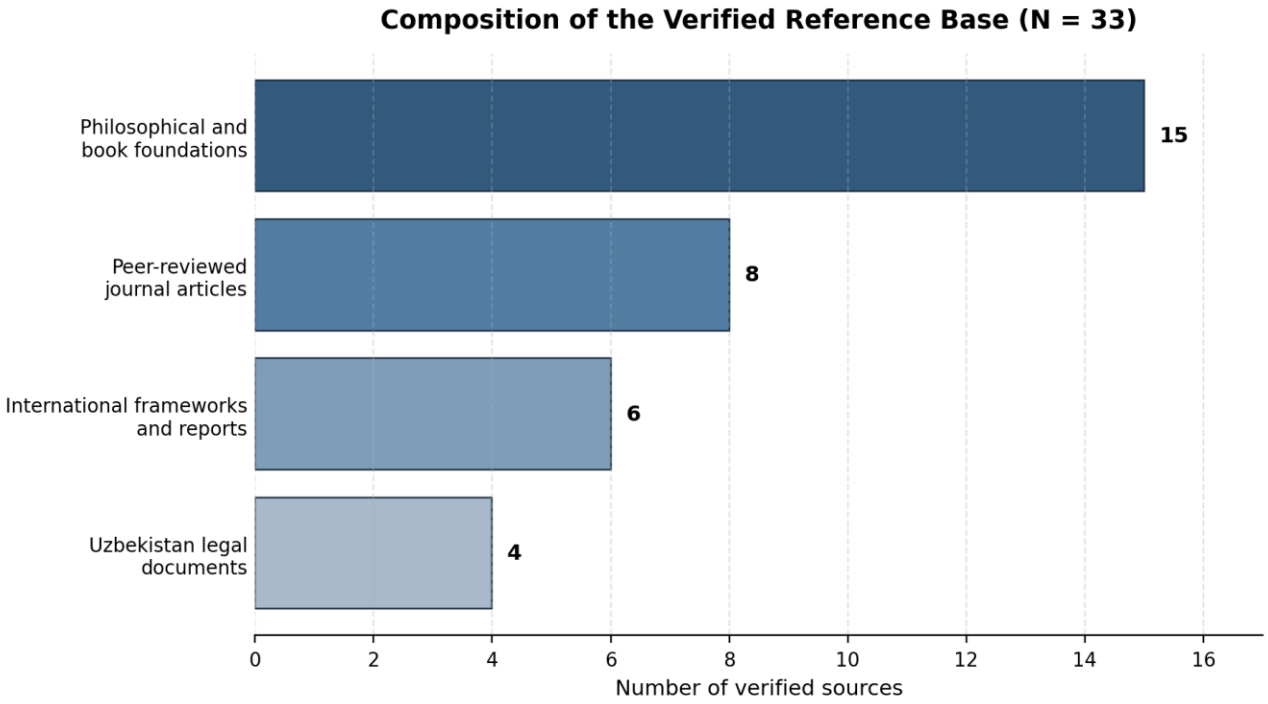


Chart 1. Composition of the verified reference base used in the manuscript.

Note. Categories were assigned by the author for descriptive purposes; the chart does not represent empirical findings about young people.

RESULTS AND DISCUSSION

The analysis supports the interpretation of moral hygiene as an integrative socio-philosophical category for maintaining spiritual and moral stability in digital society. Its structure includes ethical values, critical evaluation of information, self-control, responsibility, and observance of norms in digital communication. This interpretation is consistent with multidimensional accounts of digital citizenship, which combine ethics, media and information literacy, participation, and critical awareness (Choi, 2016; Richardson & Milovidov, 2019).

Eastern concepts of self-discipline and moral cultivation and Western theories of virtue, autonomy, self-care, and communicative responsibility are not identical; however, they converge around the need for reflective agency. On this basis, moral hygiene can perform four related functions: prevention of harmful influence, education of stable virtues, regulation of communication, and adaptation to technological change. These functions also correspond with international approaches that connect digital participation to rights, well-being, responsibility, and critical literacy (Richardson & Milovidov, 2019; UNESCO, 2021b).

The formation of moral hygiene cannot be assigned to the individual alone. Family practices, educational institutions, civil society, media organizations, and technology platforms jointly shape the informational environment in which young people make choices. Research on parental mediation shows that guidance, discussion, and age-appropriate supervision are more educationally meaningful than purely restrictive control (Livingstone & Helsper, 2008). Child-centred AI governance likewise requires safety, privacy, fairness, transparency, inclusion, and preparation for technological change (UNICEF, 2025).

The digital transformation of social life has expanded the influence of machine learning, recommendation systems, generative AI, and automated decision-making. Artificial intelligence is therefore not only a technical instrument but also part of the infrastructure through which information is selected, ranked, generated, and interpreted (Russell & Norvig, 2021). The ethical challenge lies not only in formulating principles but also in translating responsibility, fairness, transparency, and human oversight into practice (Floridi et al., 2018; Jobin et al., 2019).

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Young people must consequently learn to distinguish evidence from persuasion, verify sources, recognize synthetic or manipulated content, and understand that AI-generated outputs may be inaccurate, biased, or contextually inappropriate. In education, generative AI can support explanation, feedback, and creativity, but uncritical use may weaken independent reasoning, introduce fabricated information, and undermine academic integrity (Kasneci et al., 2023; Tlili et al., 2023; UNESCO, 2023b). Ethical AI use should therefore be taught together with source evaluation, disclosure, authorship responsibility, and human verification.

The family remains a major setting for the development of moral hygiene. Within the home, children learn habits of information consumption, online etiquette, privacy protection, respect, and responsibility. Parents who discuss online experiences and model purposeful technology use can support young people more effectively than those who rely only on prohibition or surveillance (Livingstone & Helsper, 2008).

Mahalla organizations, schools, universities, youth organizations, and other civil-society institutions can reinforce moral immunity through reading programmes, media-literacy training, ethical discussion, and constructive social participation. In Uzbekistan, such initiatives should be aligned with constitutional protections and the national legal frameworks governing education, youth policy, and informatization (Republic of Uzbekistan, 2003, 2016, 2020, 2023).

International frameworks increasingly treat digital competence as a combination of technical ability, critical literacy, ethical judgment, rights awareness, and well-being. The Council of Europe's digital-citizenship framework organizes these competencies around being online, well-being online, and rights online (Richardson & Milovidov, 2019). UNESCO's media and information literacy curriculum emphasizes critical evaluation, responsible creation and sharing of information, and resilience against misinformation (UNESCO, 2021b).

Recent AI-specific guidance extends these principles by requiring human-centred governance, protection of children's rights, transparency, privacy, accountability, and age-appropriate education. UNESCO's AI ethics recommendation and guidance for generative AI in education, together with UNICEF's child-centred AI guidance, indicate that technical literacy must be integrated with ethical responsibility and institutional safeguards (UNESCO, 2021a, 2023b; UNICEF, 2025). These international frameworks support an integrated model rather than isolated lessons on online safety.

On the basis of the philosophical synthesis and contemporary digital-ethics frameworks, the author proposes a Digital Moral Hygiene Model consisting of five mutually reinforcing components (Figure 1):

- ✓ Spiritual values developing honesty, conscience, responsibility, tolerance, and humanism.
- ✓ Critical thinking, analyzing information, drawing evidence-based conclusions, and identifying manipulative influences.
- ✓ Media and information culture selecting reliable sources, disseminating information responsibly, and adhering to the ethics of digital communication.
- ✓ Artificial intelligence ethics using generative artificial intelligence tools based on the principles of academic integrity and responsibility.
- ✓ Moral self-control is the individual's evaluation of their own actions, regular self-improvement, and striving for spiritual perfection.

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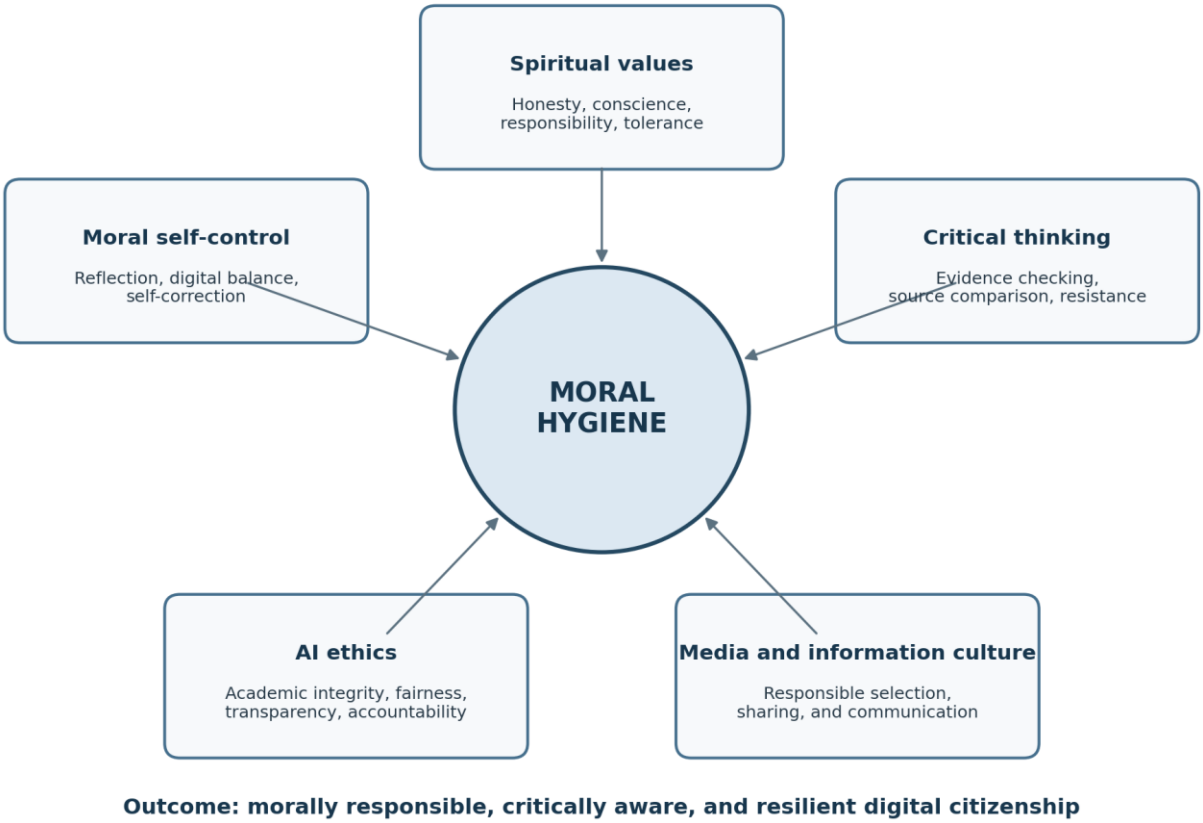


Figure 1. Digital Moral Hygiene Model for young people in an AI-mediated environment.

Note. The model is a theoretical synthesis developed in this study; arrows indicate reciprocal reinforcement rather than a fixed causal sequence.

The practical significance of the model lies in its possible application in higher education institutions, general education schools, mahalla organizations, and youth programmes. Figure 1 presents the relationship among its five components. The model can guide the development of short courses, media-literacy modules, AI-use policies, reflective activities, and spiritual-educational projects. Its effectiveness, however, should be tested in future empirical research rather than assumed from theoretical analysis alone.

CONCLUSION

This socio-philosophical analysis defines moral hygiene as a preventive and reflective system through which young people regulate their digital conduct, evaluate information critically, and align technological use with ethical values. The concept integrates traditions of virtue, moral self-discipline, autonomy, care of the self, and communicative responsibility with contemporary approaches to digital citizenship and media and information literacy (Choi, 2016; Richardson & Milovidov, 2019).

The proposed Digital Moral Hygiene Model consists of five mutually reinforcing components: spiritual values, critical thinking, media and information culture, AI ethics, and moral self-control. Its implementation requires coordinated action by families, educational institutions, mahalla organizations, civil society, media organizations, technology platforms, and public authorities. International guidance indicates that young people's engagement with AI should be supported by safety, privacy, fairness, transparency, accountability, human oversight, and age-appropriate education (UNESCO, 2021a, 2023b; UNICEF, 2025).

The model is theoretical and should not be interpreted as an empirically validated causal framework. Future studies should operationalize its components, develop reliable measurement instruments, examine young people's actual digital practices, and test educational interventions in different

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social and cultural settings. Such research would clarify whether moral-hygiene education improves source verification, responsible AI use, digital self-control, and resilience against manipulative information.

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USE OF INNOVATIVE TECHNOLOGIES IN STUDYING THE HERITAGE OF SCIENTISTS IN EDUCATION LESSONS

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ABSTRACT

This article examines the theoretical and practical potential of innovative educational technologies for teaching the scientific, pedagogical, and spiritual heritage of Eastern scholars. The study aims to identify effective approaches for integrating the ideas of Abu Mansur Maturidi, Abu Nasr al-Farabi, Ibn Sina, Alisher Navoi, and other thinkers into contemporary educational lessons. The analysis draws on historical, comparative, integrative, and pedagogical methods to connect classical views on knowledge, morality, human perfection, and social responsibility with modern learner-centered education. Particular attention is given to interactive techniques, information and communication technologies, project-based learning, problem-based instruction, multimedia resources, discussion, brainstorming, clustering, and visual comparison methods. The findings indicate that these technologies can transform the heritage of scholars from passively received information into an active source of inquiry, reflection, collaboration, and value formation. Their systematic use may strengthen students' independent and critical thinking, creativity, communication skills, national identity, respect for universal values, and social engagement. The article argues that effective integration requires clear learning outcomes, age-appropriate materials, carefully designed activities, and meaningful assessment. It concludes that combining scholarly heritage with innovative pedagogy can improve both the educational and formative dimensions of lessons and contribute to the development of knowledgeable, morally responsible, and socially active learners.

ACCEPTED

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Keywords: *heritage of scholars, educational lesson, innovative pedagogy, interactive methods, spiritual education, competence, pedagogical technology.*

INTRODUCTION

In today's globalization environment, the spiritual upbringing of the younger generation, its development based on national values and universal principles, is one of the urgent tasks of the education system. In this regard, the organization of educational lessons based on the heritage of Eastern scholars is of particular importance. The ideas put forward in the works of scholars - humanism, moral purity, the pursuit of knowledge, patriotism and perfection - serve as an important methodological basis for educating young people in the modern education system. By using innovative pedagogical technologies in educational lessons, it is possible to increase the ability of students to think independently, creative thinking and social activity. Therefore, this article scientifically analyzes the issue of integrating innovative pedagogical technologies into educational lessons, based on the heritage of scholars.

SCHOLARS' HERITAGE AS A PEDAGOGICAL RESOURCE

The importance of the heritage of scholars in the process of education - enlightenment is also mentioned in our ancient historical heritage "Avesta". In it, the manifestation of goodness through enlightenment is interpreted as the implementing power of good thoughts, good ideas and good deeds. In addition, such scholars of the Renaissance period as Imam Bukhari, Imam Maturidi, Hakim Termizi, Ahmad Yassavi, Bahauddin Naqshband made a great contribution to the creation of universal values through their incomparable enlightening works.

The place and merits of Abu Mansur Maturidi in the spiritual heritage of the Uzbek people are incomparable. According to sources, in the year of Imam Bukhari's death, in 870 AD, was born Imam Maturidi, another classic figure in our history. In this story, it seems that Imam Maturidi took up the luminous pen of Imam Bukhari and decided to continue his good deeds. In the 10th century was founded “the Maturidi teaching”, by Samarkand thinker Abu Mansur Maturidi, who became famous as "Imam al-Huda" (Imam of the Path of Guidance), and this teaching is widespread throughout the Islamic world.

Our First President I.A.Karimov, in his work “The Invincible Power of Spirituality”, described this great man who played an important role in the history of the consciousness, thinking, and artistic culture of our people - our grandfather Imam Moturidi, who risked his life in an extremely dangerous situation in the Middle Ages and set an example of spiritual courage that would serve as an example for generations, and who was awarded the high honor of being the corrector of the faith of Muslims in the Islamic world—an assessment that emphasizes Maturidi's intellectual and moral significance (Karimov, 2008). Of course, Imam Moturidi, who has his place in world history, had a great influence on the thinking of all mankind and took a worthy place in the development of moral enlightenment. His ideas and views are of universal importance. Enlightenment is the path leading to spirituality, a means of shaping it. The Enlightenment is an integral part of the history of the nation.

At the seventy-second session of the United Nations General Assembly, President Shavkat Mirziyoyev proposed a resolution entitled “Enlightenment and Religious Tolerance”; the General Assembly subsequently adopted Resolution 73/128 without a vote (Mirziyoyev, 2017; United Nations General Assembly, 2018). The main goal of this document is to ensure the right of everyone to education, to help eliminate illiteracy and ignorance. This resolution is aimed at establishing tolerance and mutual respect, ensuring religious freedom, protecting the rights of believers, and preventing their discrimination. As a result of the formation of etiquette and behavioral norms in human activities, a culture of etiquette is acquired, and at the same time, etiquette requires compliance with this rule and law.

Since ancient times, the main criterion for the formation of a well-rounded person has been the formation of intellectual maturity, sound thinking, high talent, creativity, good character, and enlightenment education. Many of Maturidi's works have served as the basis for the works of many scholars. One of these is the commentary of Alauddin Abu Bakr Muhammad ibn Ahmad Samarkandi. It was called "Ta'wilat ahl as-sunna". Maturidi's teachings, based on the idea of tolerance, pay great attention to the role and importance of human intelligence in the process of acquiring knowledge. This, in turn, played an important role in the wide popularization of this teaching. Today, humanity still needs such ideas. Preserving, studying, and transmitting historical heritage is an important educational responsibility, and culturally responsive and technology-supported approaches can connect inherited knowledge with learners' contemporary experience (Ladson-Billings, 1995; Ott & Pozzi, 2011).

Eastern thinkers in their works have deeply highlighted the inextricable link between human education, spiritual maturity, and social development. Their pedagogical views have not lost their relevance in today's educational process. For example, Abu Nasr Al-Farabi, in his work “The City of Virtuous People,” emphasizes that the spiritual maturity of a person is the basis of social development. According to him, the harmony of upbringing and education is an important factor in the formation of a virtuous and socially responsible person (Al-Farabi, 2016). Ibn Sina, in his pedagogical views, notes the

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need for the upbringing process to be organized in a step-by-step manner and in accordance with age. In his opinion, education and upbringing should serve the mental and physical development of a person (Borhani Nejad et al., 2013). The ideas of spiritual and moral upbringing of young people, encouraging honesty, justice, and hard work are also put forward in the works of Alisher Navoi. Navoi considers the harmony of science and morality to be the main criterion in the upbringing of a perfect person (Navoiy, 2011). Therefore, the use of the heritage of scholars in educational lessons helps students to understand their national identity, respect spiritual values, and feel social responsibility.

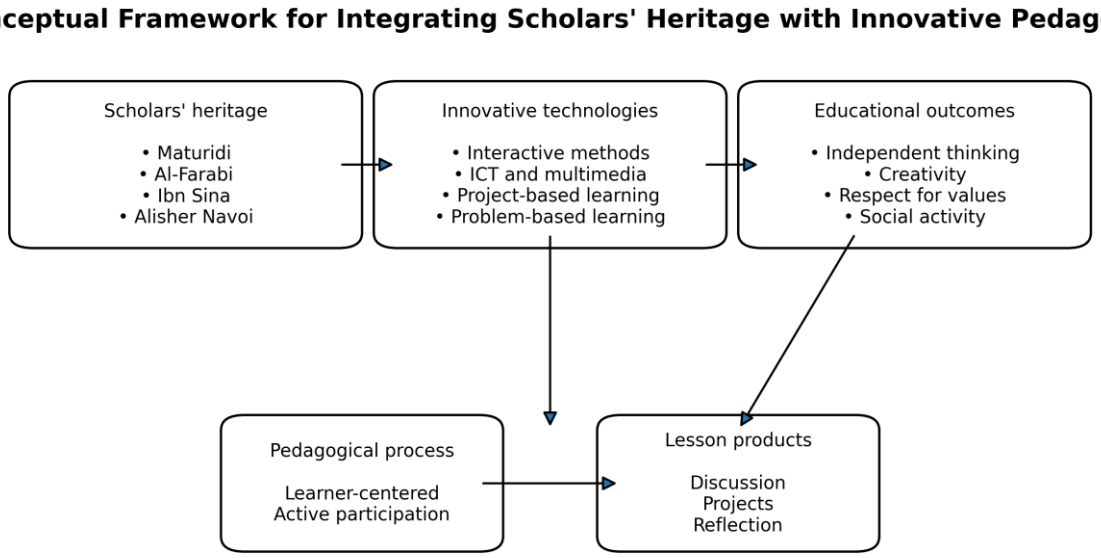


Figure 1. Conceptual framework for integrating scholars' heritage with innovative pedagogical technologies in educational lessons.

INNOVATIVE PEDAGOGICAL TECHNOLOGIES

Innovative pedagogical technologies are a set of modern methods and techniques aimed at effectively organizing the educational process, increasing student activity, and developing independent learning skills. They serve to improve traditional teaching methods and organize the educational process in a person-oriented manner.

Research on technology integration indicates that innovative educational practice should combine sound pedagogy, disciplinary content, active participation, and purposeful use of digital tools (Mishra & Koehler, 2006; Tamim et al., 2011; Schmid et al., 2014):

- orientation to the student's personality;
- interactivity;
- development of independent thinking;
- effective use of information technologies;
- increasing the effectiveness of education.

The use of innovative technologies in educational lessons increases students' interest in the lesson process, encourages them to actively participate, and ensures the effectiveness of spiritual education.

APPLICATION OF INNOVATIVE TECHNOLOGIES IN EDUCATIONAL LESSONS

In the effective organization of educational lessons based on the heritage of scientists, it is advisable to use the following innovative pedagogical technologies:

1. Interactive methods - encourage students to think actively, develop their communication and cooperation skills. Ideas from the works of scientists can be analyzed using methods such as

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"Brainstorming", "Discussion", "Cluster", "Venn Diagram". For example, a structured group discussion of Al-Farabi's views on the virtuous person can encourage analysis, argumentation, and independent conclusions. Reviews and meta-analyses support active learning approaches that require students to discuss, solve problems, and explain their reasoning (Freeman et al., 2014; Prince, 2004).

2. Information and communication technologies – through multimedia presentations, video lessons, electronic resources, interesting information about the life and work of scientists can be provided. This increases students' interest in the lesson and develops visual perception. For example, presenting selected passages from Navoi's works through carefully designed audio, video, and digital-storytelling activities can support interpretation and learner engagement (Ott & Pozzi, 2011; Robin, 2008).

3. Project-based educational technology – the project method develops students' creative and research activities. A project on “The Heritage of Scholars and Modern Education” can require students to locate sources, evaluate evidence, produce a digital or written product, and present conclusions; these activities correspond to established principles of project-based learning (Bell, 2010).

4. Problem-based educational technology – by creating problem situations, students can develop independent thinking and problem-solving skills. For example, problem scenarios concerning healthy living, ethics, or education based on Ibn Sina's ideas can promote inquiry and reasoned problem solving (Hmelo-Silver, 2004).

EXPECTED EDUCATIONAL OUTCOMES

The use of innovative pedagogical technologies in educational lessons leads to the following results:

- develops students' spiritual and moral awareness; forms independent thinking and creative approach;
- increases respect for national values;
- ensures educational effectiveness;
- enhances social activity of students.

Evidence from research reviews and meta-analyses indicates that well-designed active learning generally improves student achievement compared with lecture-dominant instruction, although outcomes depend on implementation quality and context (Freeman et al., 2014; Prince, 2004).

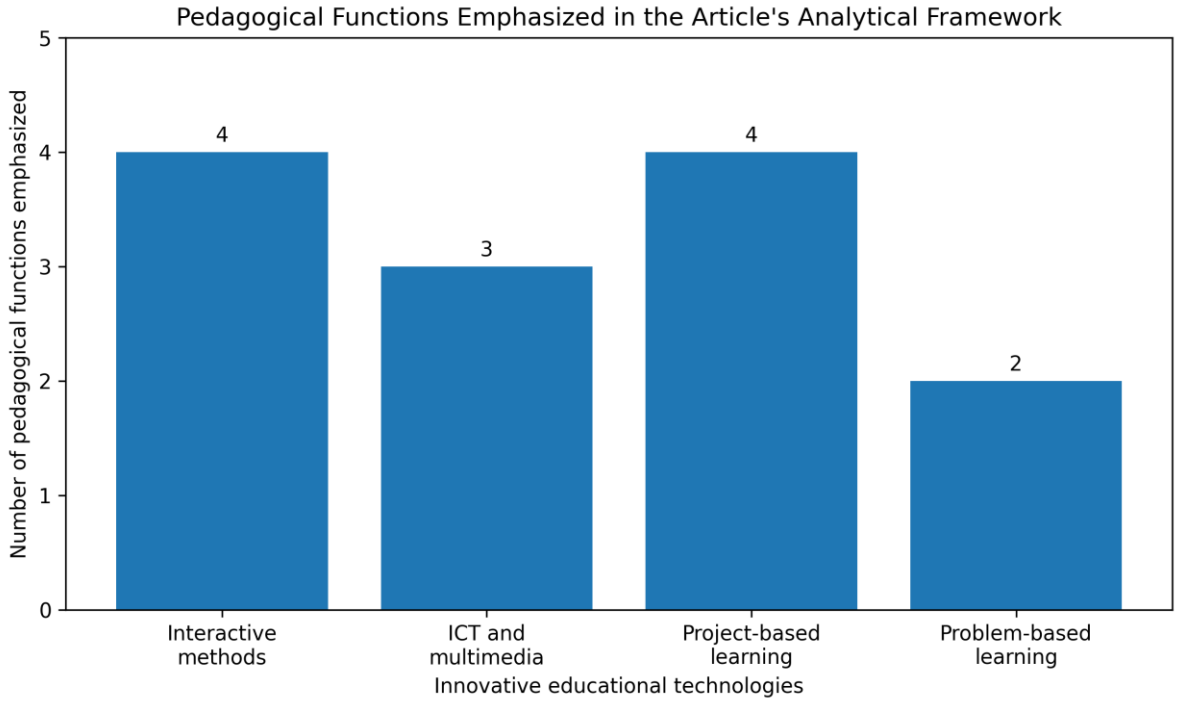


Chart 1. Pedagogical functions emphasized for each innovative technology in the article’s analytical framework.

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CONCLUSION

The use of innovative pedagogical technologies in educational lessons based on the heritage of scholars is an important factor in the spiritually mature upbringing of the younger generation. The effectiveness of the educational process can be increased by combining the pedagogical views of Eastern thinkers with modern educational technologies. Also, the use of interactive methods, information technologies and a project approach develops students' independent thinking, creativity and social activity skills. In the future, the widespread introduction of innovative pedagogical technologies based on the heritage of scholars in the organization of educational lessons will be of important scientific and practical importance.

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TEACHING THE TOPIC "NUCLEAR COMPOSITION: ELECTRIC AND BARYON CHARGES" USING THE BRAINSTORMING METHOD

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ABSTRACT

This article examines the teaching of the topic "Nuclear Composition: Electric and Baryon Charges" through modern pedagogical technologies. The study aimed to present this conceptually demanding area of physics in an understandable, engaging, and effective manner through the brainstorming method. The role of interactive learning in teaching elements of nuclear and particle physics, developing independent reasoning, and increasing classroom participation was analyzed from scientific and methodological perspectives. The pilot work involved first-year students in the Medical Physics program. The topic was taught through a traditional approach and through brainstorming, after which student achievement was assessed descriptively. The reported mastery rate was 69% for the traditional approach and 78% for brainstorming. The number of students receiving the highest grade increased, while the number receiving the lowest passing grade decreased. These findings suggest that structured idea generation, peer explanation, and teacher-guided verification may support a deeper understanding of the atomic nucleus, electric charge, quark composition, and baryon number. Because the sample was small and the design did not include randomization or inferential testing, the results should be interpreted as preliminary methodological evidence rather than a definitive causal estimate.

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Keywords: *atomic nucleus, proton, neutron, electric charge, baryon charge, brainstorming, interactive method, pedagogical technology, nuclear physics.*

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Introduction

At present, modernizing the education system and widely introducing innovative pedagogical technologies into the learning process are among the priority directions of educational development. The use of modern methods in teaching the natural sciences, including physics, is particularly important for improving learning outcomes. Physics is a fundamental discipline that explains natural phenomena and processes on a scientific basis and therefore plays a major role in shaping students' scientific worldview. Physics education research emphasizes that students need opportunities to connect formal representations with reasoning, discussion, and conceptual reconstruction rather than relying only on passive reception of information [2,3]. Consequently, physics education must not only ensure the acquisition of theoretical knowledge but also develop students' ability to think independently, analyze problematic situations, and draw scientifically justified conclusions.

The selected topic is difficult because it requires students to distinguish several related but non-identical levels of description. At the nuclear level, protons and neutrons are nucleons; at the subnuclear

level, they are baryons composed of quarks. Electric charge describes electromagnetic interaction, whereas baryon number is a separate additive quantum number used to classify baryonic matter. Contemporary particle-physics references classify ordinary baryons as three-quark states and organize the spin-1/2 octet and spin-3/2 decuplet according to quark content and quantum numbers [1]. Students may memorize these diagrams without understanding why a proton has charge +e, a neutron has zero net charge, or why both have baryon number one. A discussion-based lesson can expose these partial models and help the teacher connect macroscopic matter, atoms, nuclei, nucleons, and quarks within one coherent explanatory hierarchy.

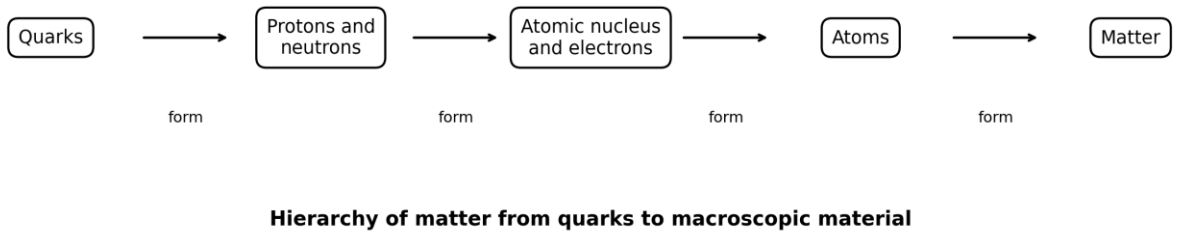


Figure 1. The hierarchical organization of matter from quarks to macroscopic material.

Using the brainstorming method to teach the topic "Nuclear Composition: Electric and Baryon Charges" helps students examine complex physical concepts through active verbalization and peer interaction. Students are not only recipients of prepared information but participants who propose explanations, compare alternatives, and revise their reasoning. Problem-based questions and open discussion encourage them to consider the composition of the atomic nucleus, the properties of protons and neutrons, the physical meaning of electric charge, and the conservation of baryon number. This movement from passive reception toward constructive and interactive engagement is consistent with the ICAP framework and established principles of physics education research [2,3,9].

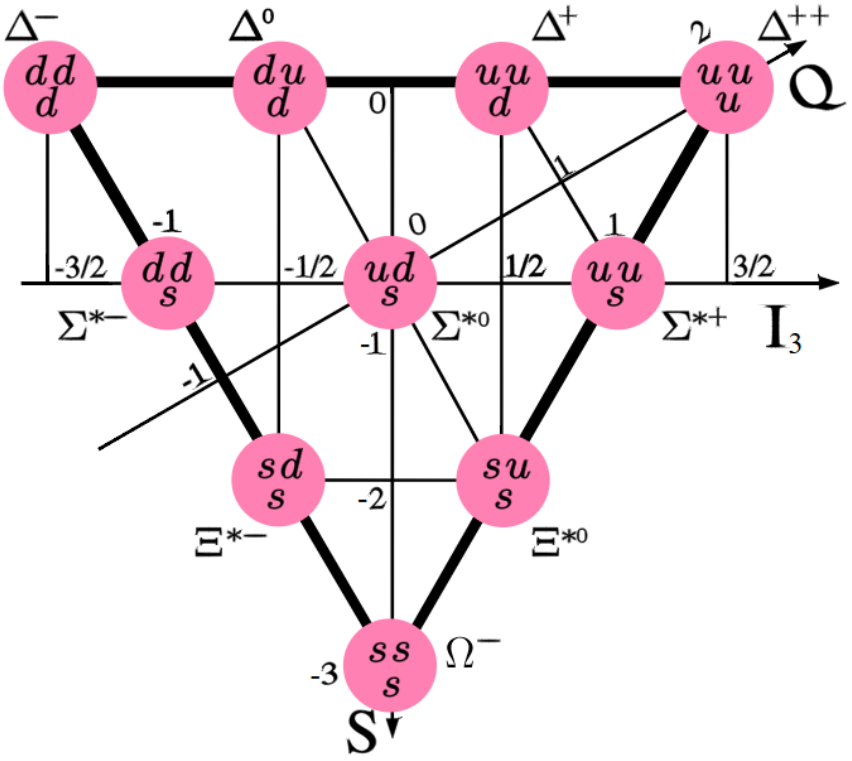


Figure 2. Baryons with spin 3/2 composed of combinations of three u, d, or s quarks: the uds baryon decuplet.

Educational research consistently indicates that well-designed active learning can outperform uninterrupted lecture-based instruction in science and physics courses [4-8]. A major advantage of brainstorming is that it encourages students to generate and communicate ideas before the teacher supplies a final explanation. Every student can contribute an initial model, question, or hypothesis, which strengthens confidence, improves scientific communication, and develops collaborative problem solving. The method is particularly useful when the topic contains abstract entities that cannot be observed directly, because discussion makes students' assumptions visible and allows misconceptions to be addressed during the lesson.

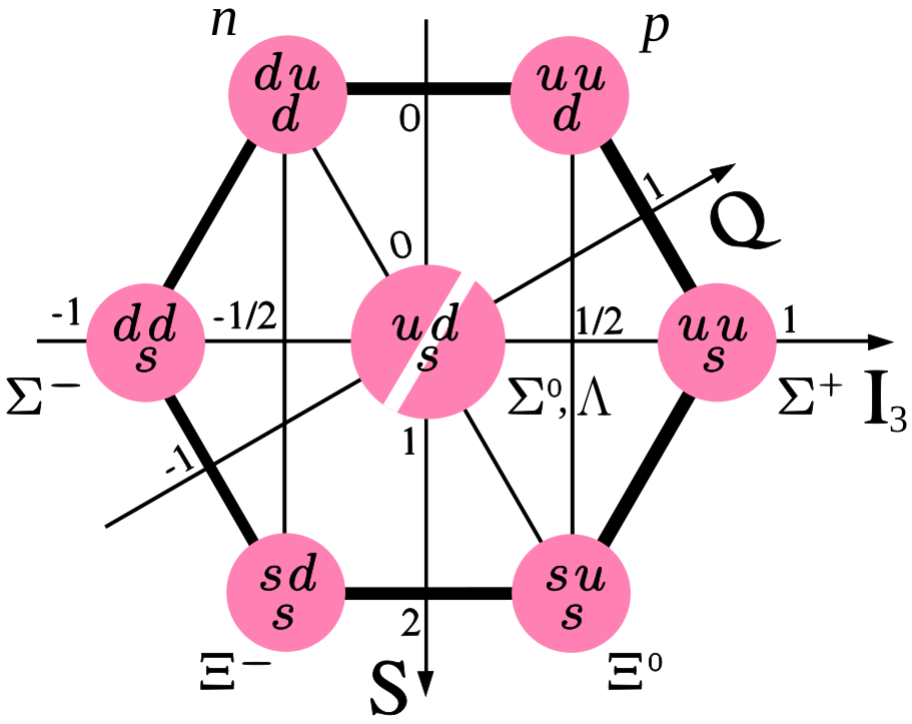


Figure 3. Baryons with spin 1/2 composed of combinations of three u, d, or s quarks: the uds baryon octet.

This article analyzes the pedagogical potential of the brainstorming method in teaching the topic "Nuclear Composition: Electric and Baryon Charges." It also considers the theoretical and practical aspects of using interactive methods and substantiates their importance for developing students' knowledge, skills, and competencies. The main objective is to demonstrate the advantages of brainstorming in teaching complex concepts of nuclear physics and to develop methodological recommendations aimed at increasing the effectiveness of physics education.

Methodology

Brainstorming is a structured idea-generation method used to stimulate divergent thinking and collaborative problem solving. Its central principle is to generate a broad range of ideas before evaluating them. During the initial phase, criticism is postponed, unusual ideas are welcomed, and participants are encouraged to develop or combine the contributions of others. Reviews and experimental studies show that the quality of the procedure depends on clear rules, balanced participation, opportunities for individual reflection, and a separate stage for evaluating ideas [12-15]. In an educational setting, the teacher therefore acts as a facilitator during idea generation and as a scientific moderator during the subsequent verification stage.

The brainstorming method corresponds closely to competency-based education because it combines conceptual knowledge with communication, information processing, argumentation, and problem-solving competencies. The ICAP framework predicts that interactive and constructive engagement should produce stronger learning than active manipulation alone or passive listening [9]. In

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the present topic, students were expected not merely to name particles but to explain relationships among quark charge, nucleon charge, baryon number, nuclear composition, and conservation laws.

Pedagogical Design of the Lesson

The lesson can be organized in five sequential stages. First, the teacher presents a diagnostic prompt such as “What particles constitute the nucleus, and what determines their electric and baryon charges?” Students write brief individual responses so that less vocal participants also formulate an initial idea. Second, the class generates possible explanations without immediate criticism. Third, the teacher groups the ideas into categories: nuclear composition, electric charge, quark structure, and conservation laws. Fourth, the class tests each category against accepted scientific models, using the quark charges u = +2/3e and d,s = -1/3e to reconstruct the proton and neutron charges. The baryon octet and decuplet diagrams are then used to compare spin states and quark combinations. Finally, students produce a concise written explanation or concept map showing the hierarchy from quarks to matter. This sequence preserves the creative stage of brainstorming while ensuring that scientifically inaccurate ideas are explicitly corrected.

The post-lesson assessment used the same intended learning outcomes for both instructional approaches and classified performance according to grades 5, 4, and 3. The reported percentages and grade frequencies were summarized descriptively. Because the available dataset does not report a pre-test, random assignment, confidence intervals, or measures of variance, no inferential claim is made about statistical significance. For a stronger design, future work should use equivalent comparison groups, a validated concept test, common scoring rubrics, and pre-test/post-test analysis.

Results

The study was conducted among first-year students of the 70530507 Medical Physics program in group FIZ-MAG-TF-UZ-2401. The available summary reports 26 student results for the traditional instructional condition and 26 student results for the brainstorming condition. Because the source dataset does not clarify whether these were two independent groups or repeated observations of the same cohort, the comparison is treated as descriptive. At the end of the lesson, assessment tasks were administered to evaluate students’ knowledge, and the grade distributions were summarized.

In the lessons organized through the traditional method, the reported mastery rate was 69%. In the lessons organized through brainstorming, students participated actively and expressed their views freely regarding the topic. As a result, the reported mastery rate increased to 78%. The results are presented in Table 1.

Table 1

Student Achievement Indicators

Assessment category	Traditional method	Brainstorming method
Students receiving grade "5"	6 students	10 students
Students receiving grade "4"	8 students	9 students
Students receiving grade "3"	12 students	7 students
Total number of students	26 students	26 students
Mastery rate	69%	78%

Discussion

As shown in Table 1, the distribution of grades shifted in a favorable direction under the brainstorming condition. The number of students receiving grade 5 increased from 6 to 10, whereas the number receiving grade 3 decreased from 12 to 7. The reported mastery rate increased by 9 percentage points, from 69% to 78%. These descriptive changes are compatible with a broader body of research showing that interactive engagement, peer instruction, and active learning can improve conceptual performance in physics and other STEM disciplines [4-8].

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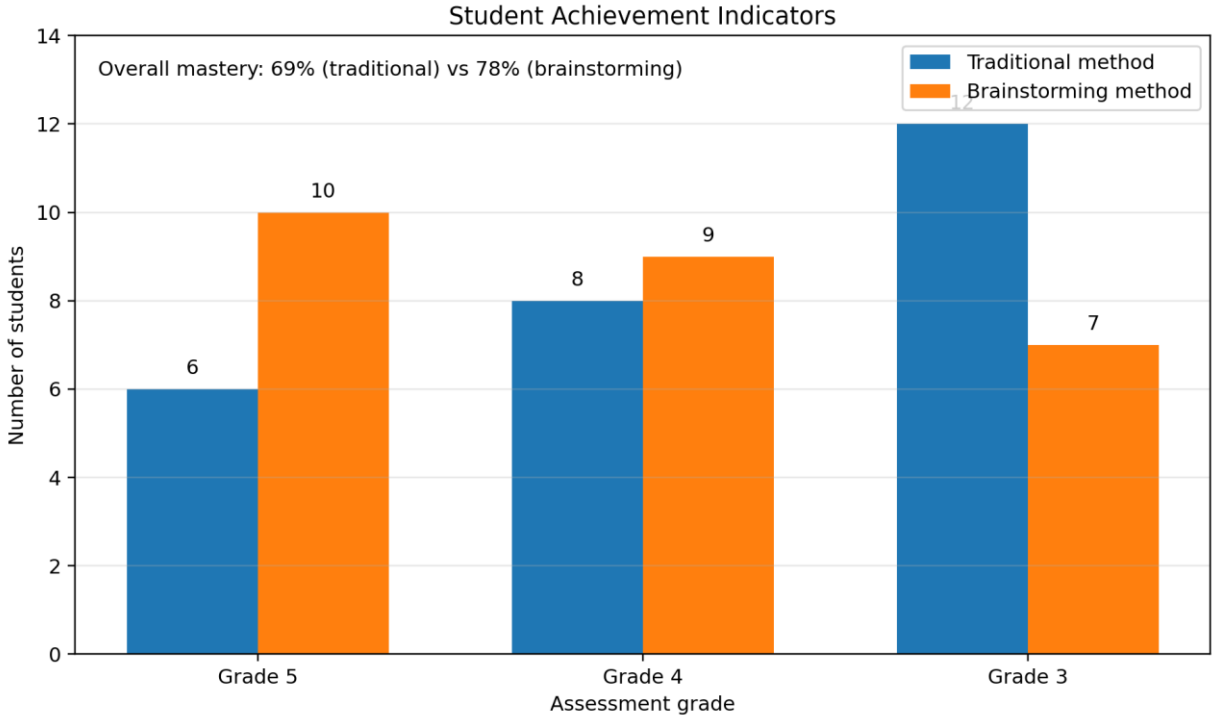


Chart 1. Distribution of students' grades under the traditional and brainstorming methods.

The chart-based analysis suggests that brainstorming can function as a pedagogical tool for increasing participation and making student thinking visible. Its value is not simply that students speak more; rather, the method requires them to retrieve prior knowledge, articulate a model, compare it with peer explanations, and revise it after scientific verification. Studies of active classrooms have shown that students may feel that they learn less when an activity is cognitively demanding even when their measured learning is greater [10]. This finding is relevant to nuclear physics, where productive difficulty and conceptual conflict may be necessary for replacing intuitive but incorrect models with scientifically coherent explanations.

The findings also have implications for inclusive classroom participation. A brainstorming lesson can create multiple entry points: students may contribute a definition, a calculation, a diagram, an analogy, or a question. When participation is carefully structured, active learning can reduce achievement disparities and increase access to disciplinary reasoning [11]. However, unstructured group brainstorming may allow dominant students to control discussion or may produce many ideas without sufficient evaluation. Combining brief individual idea generation with group discussion, teacher categorization, and evidence-based verification is therefore preferable to an unrestricted discussion [12-15].

Limitations and Directions for Further Research

The pilot has several limitations. The available summary reports 26 student results for each instructional condition but does not clarify whether these represent independent groups or repeated observations of the same cohort. Baseline equivalence was therefore not established. The study also did not report item-level assessment results, reliability estimates, delayed retention, or effect sizes. Consequently, the observed difference should not be interpreted as proof that brainstorming alone caused the improvement. A subsequent study should include at least two comparable classes, pre- and post-instruction concept measures, a delayed test, transparent scoring criteria, and observation of implementation fidelity. Qualitative analysis of students' explanations would also help determine whether they can distinguish electric charge from baryon number and correctly derive proton and neutron charge from quark composition.

Conclusion

The pilot work conducted with first-year Medical Physics students indicates that the brainstorming method is a promising approach for teaching nuclear composition, electric charge, and baryon number.

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The reported mastery rate increased from 69% under the traditional approach to 78% under brainstorming, accompanied by a shift toward higher grades. The method offers a structured way to reveal prior conceptions, stimulate peer explanation, and connect quark-level models with the properties of protons, neutrons, nuclei, and matter. Its educational value depends on separating idea generation from scientific evaluation and ensuring that every student participates. Because the evidence is preliminary, broader controlled studies are needed before firm causal conclusions are drawn. Nevertheless, the approach is suitable for further use and investigation in conceptually demanding physics courses.

Acknowledgment

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MANAGEMENT ACTIVITIES OF HEADS OF HIGHER EDUCATIONAL INSTITUTIONS BASED ON FOREIGN EXPERIENCE

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ABSTRACT
This article examines how foreign higher education management practices can inform the improvement of institutional governance in Uzbekistan. The study applies a comparative and analytical approach to management models used in Germany, England, the United States, and other developed systems, with particular attention to institutional autonomy, strategic planning, quality assurance, financial diversification, staff development, and international cooperation. The analysis shows that effective university management depends on a balanced combination of state regulation, internal self-governance, transparent accountability, and continuous monitoring of educational outcomes. The findings also indicate that rigid administrative structures limit institutional flexibility, whereas hybrid management models allow universities to respond more effectively to labor-market demands, technological change, and global competition. Based on the comparative evidence, the article proposes strengthening strategic leadership, expanding financial autonomy, introducing modern quality-management mechanisms, developing the professional competence of academic and administrative staff, and improving external and internal evaluation systems. It concludes that a hybrid management model adapted to national conditions can enhance the competitiveness, sustainability, and educational quality of higher education institutions in Uzbekistan.

ACCEPTED

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Keywords: *management, head, educational institutions, organization, formation, higher educational institutions.*

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Introduction

The management of a higher education institution in modern conditions is, first of all, the management of its development processes. The goal of the university's management is to create a management model in which the competencies and powers, functions and responsibilities of all subjects of higher education management will be clearly distributed and coordinated.

Scientific research is being conducted in the global education system aimed at organizing the process of forming the social creativity of future education managers, improving management mechanisms, modernizing the system of training managerial personnel in education based on modern principles of quality management, and creating intelligent information systems for improving innovative activity of personnel.

The planning and control of a scientific and pedagogical career lies in the fact that from the moment a teacher is accepted into a university until he is expected to leave his job, it is necessary to organize a

systematic vertical promotion of the employee through the position system, as well as his professional development. A teacher should know not only their short- and long-term prospects, but also what indicators they need to achieve in order to count on promotion. In the process of evaluating the staff of the department, some imbalance is often revealed between the potential of the teaching staff and its required level.

In modern conditions, this is primarily due to profound changes in science and the need for teachers to familiarize themselves with a wider range of research literature, as well as the desire of many universities to introduce new programs in business, economics, law, finance and banking, programming, and foreign language learning. When such disagreements arise, there is a need to train the staff of the department, to improve their skills. In order to be competent, active, and easily receptive to innovations in any field of activity, a teacher needs a high level of qualification, achieved only through continuous, focused learning and the development of their potential.

Research Methods

The purpose of this article is to analyze the approaches of strategic management in the management of the higher education system of Uzbekistan, identify key problems and develop recommendations for their solution.

Thus, the teaching staff of the department is more focused on the professional position of the teacher. The problem of personnel development in higher educational institutions is reflected in the works of: Bagautdinova N.G., Bogdan N.N., Glukhova V.V., Egorshina A.P., Zhilina A.I., Zhurakovsky V., Korolkova V.T., Malakhova T.Yu., Manuylova V.I., Mogilevkina E.A., Prikhodko V., Reznik S.D., Romankova L.I., Sazykina O.A., Fedorov I., Shesternina O.I. and other authors.

The works of Bazarova T.Yu., Dyatlov V.A., Egorshin A.P., Kurbatova M.B., Magura M.I., Odegov Yu.G., Smirnov E.A., Travin V.V. and other authors are devoted to the organization of the process of intra-company vocational training and the study of modern methods of continuing education.

In our opinion, in the context of modernization of education, the socio -pedagogical necessity of organizing and improving the educational management process is determined by the following factors:

1. The development of science and technology, socio-economic renewal require the improvement of the continuing education system, especially the educational process in institutions of higher education, based on the study of advanced foreign experience, the use of innovative approaches and information technologies in education, taking into account the requirements of the labor market.

2. Creation and implementation of effective organizational forms and technologies of personality-oriented learning that contribute to the development of students' awareness, intellectual potential, social activity and creative skills.

3. The need to develop the professional and innovative competence of management personnel in the context of mastering and implementing innovations in educational practice.

In recent years, in Western Europe as a whole, there has been a trend of absolute and relative growth in state and other public allocations to higher education, accompanied by streamlining and strengthening external control over their spending. However, as a rule, this supervision does not affect the existing internal autonomy of universities, but is aimed at coordinating the results of their activities with the costs incurred. The governing bodies in universities and the order of their formation in Western countries are diverse. The competition between universities for the quality of specialist training in the West requires an objectively grounded approach to all components and aspects of their organization and activities. An important role in this is played by the previous preparedness of applicants, from whom the student body is recruited.

There are no departments in US universities. Academic programs are formed within the faculties, led by professors. This ensures the flexibility of the university's structure in terms of the development of new areas. The education system has a pronounced individual orientation. It ensures the formation of a

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specialist as a professional, develops the creative potential of a personality, and gives a sense of self-confidence. In general, the structure of American higher education is characterized by great diversity, depending on the volume of scientific research, the levels of academic courses taught and academic degrees awarded.

When implementing quality management in a higher education institution, first of all, there should be an interest of senior staff, that is, the rector and vice-rectors, in launching this system. Each university should implement the principles of universal quality management, adapting them to its conditions and peculiarities.

An analysis of the quality management of educational institutions allows them to be divided into two groups:

1. Under the state quality control of the education management system, which operates under the active influence of ministries and agencies, licensing, accreditation, rating, and financial resource allocation mechanisms are being implemented, with special attention being paid to evaluating the performance of educational institutions. A similar model of the quality management system is typical for many European countries (for example, France, Germany) and the Scandinavian countries (in particular, Sweden).

2. In the absence of traditional public administration structures, the functioning of the quality management system in educational institutions involves strengthening the role and importance of self-assessment procedures in the process of their formation. This approach is widely used, in particular, in the USA and the countries of Southeast Asia. The importance and relevance of such quality management models is steadily increasing within the global educational community.

The organization and management of education involves the study of current regulatory documents and advanced pedagogical conducting surveys, assessing the reliability and significance of the information collected, its analytical processing, generalization and systematization, as well as the scientifically sound application of statistical and mathematical analysis methods. This requires effective use of information collection methods.

To ensure the effectiveness of the management process of an educational institution, it is necessary to analyze the current state, make a pedagogical diagnosis and maintain the process at the required level, followed by its transfer to a qualitatively new one. degree. This requires coordination and regulation of the staff's activities. aimed at ensuring their active participation. In these conditions , the regulatory and coordinating function on the part of teachers is realized.

Most teachers who wisely use creative management methods do not demonstrate the superiority of their position, encourage students' initiative, maintain equal and sincere relationships with all students, respond appropriately to their opinions, taking into account different situations, and introduce methods of cooperation suitable for students.

The main specific features of higher educational institutions as objects of the quality management system implementation include the presence of an extensive organizational structure of three levels of management - university, faculty, department; a large number of suppliers and internal consumers, a variety of internal documents of higher educational institutions.

Results

Higher education in Germany is regulated by the Law on Higher Education, adopted by the country's parliament, as well as a series of laws of individual Countries. The coordination of activities and the development of methodological principles for the activities of higher education are carried out by the Conference of Rectors of Germany. The university's charter is developed by the staff itself. The management is carried out by the rector or president, vice-rectors or vice-presidents and the chancellor. The Academic Senate oversees academic and scientific work. It is formed from representatives of

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university departments, students, and external organizations. They are given independence in determining the structure, content and methods of teaching, in organizing scientific research, and in allocating finances.

Higher education in England is dominated by a dual system combining executive and legislative management units. The main bodies of collective management are the Board of Trustees, the Senate, and the Administrative Council. Some of the seats in the Senate (the legislative body) are occupied ex officio by the heads of the university, while other positions are held by the departments. The Administrative Council consists of the heads of university services.

Higher education in Uzbekistan is a dynamically developing system that has undergone large-scale reforms aimed at expanding the autonomy of universities, introducing academic freedom and improving quality to international standards.

The higher education system in Uzbekistan is undergoing significant changes due to the need to meet international standards and the needs of the labor market.

Chart 1 is presented below to provide a comparative visual synthesis of the management dimensions discussed in the results section.

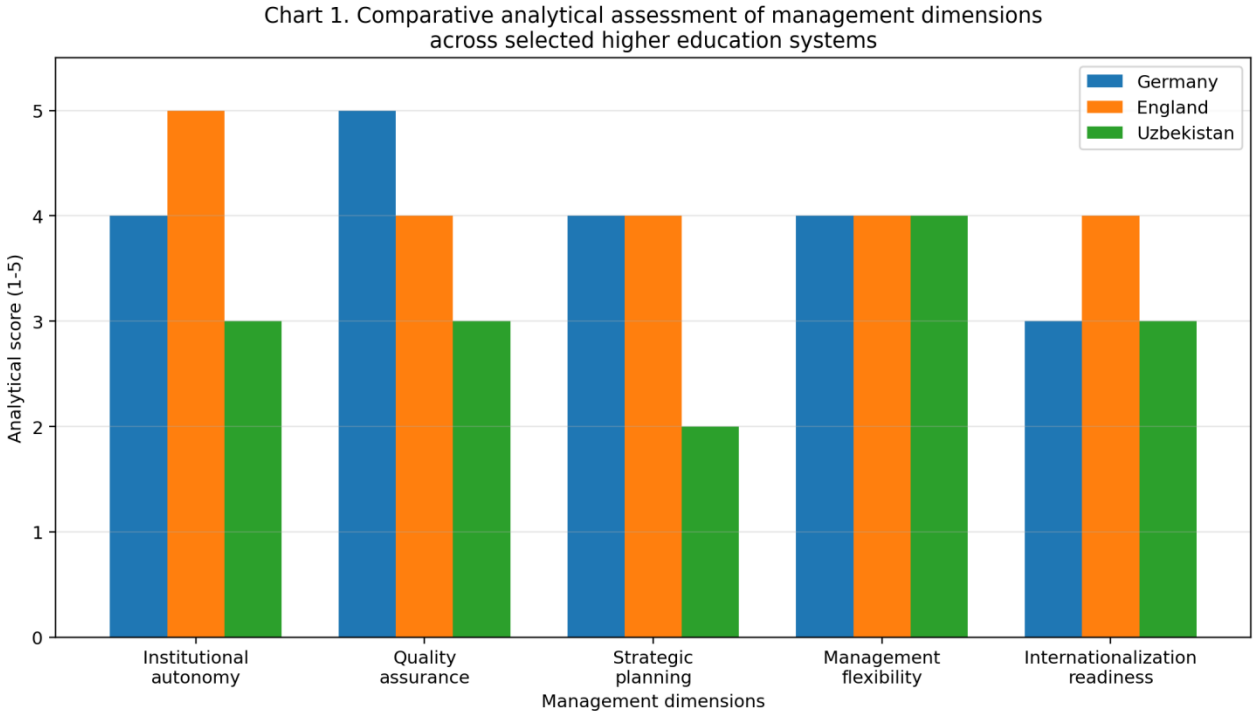


Chart 1. Comparative analytical assessment of management dimensions across selected higher education systems.

Note. The scores in the chart use a five-point analytical scale derived from the article's comparative discussion of Germany, England, and Uzbekistan. They summarize the relative emphasis placed on institutional autonomy, quality assurance, strategic planning, management flexibility, and internationalization readiness, and are intended as an interpretive visual aid rather than an independent empirical measurement.

The organization of interaction includes the following main elements: definition of joint goals, tasks, functions; definition of jointly used methods and means; information exchange procedure; procedure for joint management of performers; accounting and evaluation of the results of joint work, as well as control over them. In general, the organization of interaction is based on departmental and interdepartmental regulations and other official materials. Responsibility for interaction in the implementation of a management decision lies with the head of the relevant organization, his deputies, and heads of structural divisions (it is known that in the process of executing a decision, the success of a case significantly depends on the actions of employees within the department or service and on the interaction

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and coordination of employees of the organization with other structures, institutions, authorities and management).

Discussion

Strategic management in the higher education system involves defining the mission and goals of an educational institution, developing strategies, implementing them, and evaluating the results. According to I. Ansoff's concept, strategic planning should be based on three key elements: goals, constraints and external factors. In the context of higher education, this includes the management of intellectual capital, infrastructure and reputation of universities.

Based on the above data and the interests of the higher educational institution itself and the consumers of its educational services, the following goals can be formed for creating a quality management system in a higher educational institution:

- achieving a quality level of specialist training that meets the requirements of employers (the required level of quality in terms of the demand for university graduates and the modern competitiveness of graduates);

- achieving an operational quality level of specialist training that meets the potential requirements of employers (a promising quality level that ensures long-term operation and competitiveness of the university).

Based on the results of the analysis of a comprehensive study of the education system of the Republic of Uzbekistan conducted in 2017 by an authoritative group of foreign experts organized in cooperation with the United Nations Committee on Education, Science and Culture (UNESCO) and the consulting organization (DGP Research & Consulting), It is revealed that in the process of higher education, the integrity of theory and practice is not effectively organized, students' qualification practice is conducted at industrial enterprises, the quality control mechanism of education is not formed at the level of modern requirements, and there is a lack of qualified teaching and management personnel in educational institutions, participation of economic sectors in the formation of orders for personnel training in the future, the development of qualification requirements for graduates, and ensuring the quality of training of the necessary specialists does not meet the requirements.

This shows that the cardinal improvement of the content of training highly qualified competitive personnel in the republic's higher education system by ensuring that higher education programs meet the requirements of the changing labor market, further expanding the participation of economic sectors in improving the quality of training highly educated specialists, based on the prospects for socio-economic development of the country, the needs of society, modern achievements of science, culture, technology and technology, It is one of the most urgent tasks of today.

In higher education institutions, such mechanisms as Benchmarking (a problem-solving mechanism through comparative analysis of the components of a higher education institution's activities), Total quality management (a general management system for improving the quality of education, including: the quality of graduates, the quality of the educational process, and the quality of staff qualifications) are being introduced into pilot practice, strategic management. Along with this, it is possible to improve the quality of education in higher educational institutions through the use of educational process management systems such as Blended Learning (a system of student-teacher interaction for education through a single electronic system), Tuning (an educational process based on general professional and special competencies), as well as the organization of individual classes in teaching special disciplines based on from the specifics of the disciplines.

External quality assessment, focused on standards and performance indicators in the higher education system, is more widespread in the world. The main elements of this system are standardization and licensing, certification and accreditation, as well as a comprehensive assessment of educational institutions in general and individual specialties based on a rating system. All these processes include

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conducting internal audits. The basis for an objective assessment of the quality of education is made up of state educational standards, qualification requirements and quality indicators for their implementation.

Based on the experience of developed countries, in order to assess the quality of education and monitor it, it is necessary to rely on the following criteria:

1. Each educational program of a higher educational institution submitted for accreditation and attestation must have:

- a mechanism for evaluating and correcting the achievement of clearly formulated, documented goals that meet the university's plan and the requirements of potential consumers of this program;
- work plans and curricula of academic disciplines, the tasks of which correspond to the formulated program goals;
- continuous monitoring of the implementation of the curriculum and the solution of tasks, as well as a feedback mechanism for improving the educational program.

2. The educational program must comply with the state educational standard of the field of education, the qualification requirements of educational areas and specialties, ensure the breadth of specialist training according to the name of the program and the necessary depth of training in the established field of specialization.

3. When accrediting educational programs, an important factor is the level of students' training, the quality of education and their readiness for professional activity.

4. The teaching staff should consist of specialists from all fields of knowledge covered by educational programs. Their level of qualification can be confirmed by the following components: basic education, additional education (advanced training, internships), scientific and pedagogical experience, striving to improve educational programs and increase the effectiveness of education, participation in professional communities, receiving scholarships and grants, awarding titles in the field of science and technology, etc.

5. As a result of mastering the educational program, the graduate must have a level of readiness for professional activity.: the ability to put into practice the knowledge acquired during the period of study in their specialty; skills in planning and conducting experimental work, data analysis and application; willingness to work in a team on interdisciplinary topics; skills to formulate and solve problems based on their specialty; ability to understand professional and ethical obligations; skills of effective teamwork; development factors necessary to understand the global and social consequences of industry development decisions; understanding the need for constant search and the skills of searching and learning; knowledge of modern social, political and scientific and technical problems; skills in applying mastered methods in their work practice.

6. A higher education institution should have a system of employment, studying the quality of knowledge and skills of specialists and the demand for them, tracking their professional growth (career), continuous training and advanced training of university graduates. The information obtained through this system should be used to further improve educational programs.

The proposed recommendations, based on the principles of strategic management, can contribute to improving the competitiveness and effectiveness of Uzbekistan's higher education system.

Figure 1 below summarizes the hybrid management model proposed in this article on the basis of foreign experience and national higher education reform priorities.

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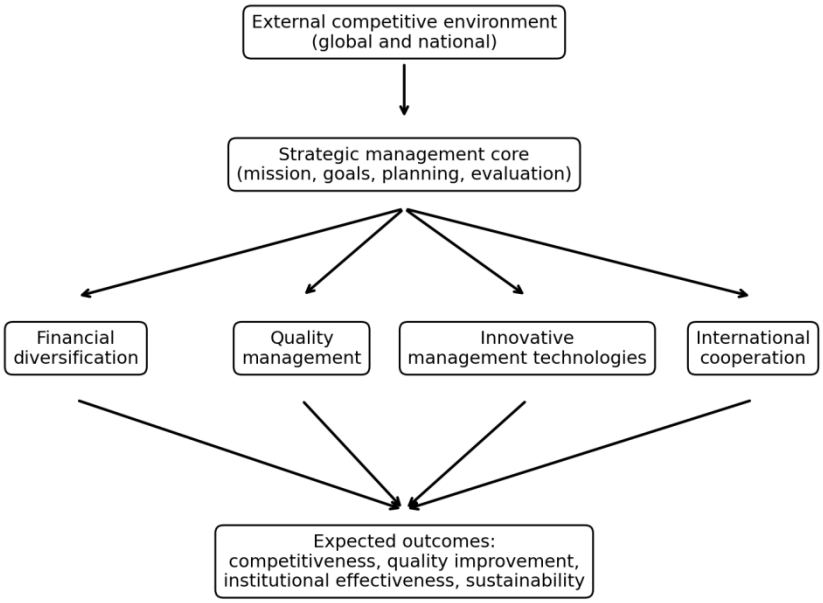


Figure 1. Hybrid management model for higher educational institutions based on foreign experience.

Note. The figure conceptualizes the interaction between the external competitive environment, the strategic management core of the institution, and four operational pillars: financial diversification, quality management, innovative management technologies, and international cooperation. Together, these components support institutional competitiveness, quality improvement, and long-term sustainability.

Conclusions and Recommendations

The following measures are proposed to improve the effectiveness of university management based on strategic management: Universities should develop long-term strategies that include goals for modernizing educational programs and increasing competitiveness. Expanding the practice of financial independence for a larger number of universities in order to attract extra-budgetary funds.

Therefore, the head always has the goal of creating a team that successfully fulfills its professional and pedagogical purpose; so that professional abilities develop in a socio-psychological atmosphere, and antisocial traits and inclinations are suppressed.

In this regard, the head always acts not only as the organizer of the work of people subordinate to him, but also as their educator, as a teacher. This means that modern administrators should not lose sight of the educational and pedagogical consequences of their managerial work; they cannot help but think about how the implementation of the planned decisions will affect the personal qualities of subordinates. The primary responsibility of managers is to improve the efficiency and quality of collective work, to form the necessary personal qualities in subordinates.

When managing the quality of higher education and improving it, the following recommendations should be taken into account:

1. In our republic, in order to improve the quality and competitiveness of higher education, measures should be taken to effectively use its diagnostic methods.

2. Diagnostic indicators and quality parameters of education need to be constantly changed and supplemented based on the analysis of international experience.

3. In order to ensure the quality and competitiveness of higher education in the republic, the study of modern methods of quality of higher education in developed countries can accelerate the entry of higher education institutions into internationalization.

4. Based on the best foreign experience, it is advisable for independent organizations to diagnose the quality of education in higher education institutions in our republic, as well as for each higher

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educational institution to independently determine quality indicators and demonstrate the level of its positions.

5. The development of the higher education system can be achieved through continuous improvement of the quality and level of professional skills of teaching staff, advanced training and internships of teaching and research staff abroad, increasing the potential of staff along with improving their quality and competitiveness.

6. Further improvement of education quality management mechanisms is needed. Because diagnostics helps to identify positive and negative factors affecting the quality of education. That is, along with gaps in the level of professional training, it also serves to demonstrate high results, achievements, exemplary, advanced working methods used by advanced teachers, and the level of their pedagogical skills.

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DIGITAL JOURNALISM IN THE MODERN EDUCATION SYSTEM: INTEGRATION CHALLENGES AND DEVELOPMENT VECTORS

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ABSTRACT

Digital journalism is increasingly relevant to education because students must not only consume information but also search for, verify, produce, and distribute digital content. This conceptual article examines the barriers to integrating digital journalism into the modern education system and identifies practical development vectors. A narrative review of foundational media theory, recent OECD, UNESCO, and Reuters Institute reports, and scholarship from Russia and Uzbekistan was used to synthesize the literature. Four interrelated challenges emerge: uneven teacher competence; lagging curricula and methodological guidance; unequal access to reliable internet connections and suitable devices; and information-integrity risks intensified by generative artificial intelligence, synthetic media, and platform logics. The analysis identifies four development vectors: project-based convergent newsrooms; platform-supported production through blogs, messaging channels, podcasts, and video; multimedia assignments combined with portfolio assessment; and human-centered AI literacy focused on transparent use, verification, attribution, and ethics. The article argues that digital journalism should be treated not merely as specialist training but as a cross-curricular mechanism for media and information literacy, critical thinking, collaborative production, and responsible participation. Sustainable integration requires coordinated curriculum renewal, teacher development, infrastructure support, assessment standards, and institutional rules for artificial intelligence and publication ethics.

ACCEPTED

31.07.26

Keywords: *digital journalism, digital education, EdTech, media and information literacy, critical thinking, generative artificial intelligence.*

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Introduction

The relationship between communication technology and education is not new, but the speed and scope of current digital change are distinctive. McLuhan emphasized that media technologies reshape not only the distribution of messages but also the social environments in which people perceive and act [1]. In a network society, communication increasingly occurs through interconnected digital infrastructures [2], while convergence brings together text, audio, video, data, and audience participation within shared platforms [3]. These developments require journalism theory and education to be reconsidered in relation to changing institutions, professional roles, and media practices [4, 5].

Education is affected at two levels. First, institutions use digital platforms to deliver, manage, and

assess learning. Second, students encounter a continuous stream of news, commentary, advertising, user-generated content, and algorithmically recommended material outside formal instruction. Digital education therefore cannot be reduced to transferring lectures and textbooks to an online environment. It must also develop the ability to locate information, evaluate sources, verify claims, create multimodal content, and communicate responsibly. These competencies connect digital journalism with the wider aims of media and information literacy [6-9].

Digital journalism is relevant beyond journalism faculties. Its practices - source evaluation, fact-checking, interviewing, data interpretation, visual storytelling, editing, attribution, and ethical publication - provide a practical framework for teaching critical engagement with information. Regional scholarship has likewise emphasized the importance of adapting media-literacy education to national educational and cultural contexts, including Uzbekistan [10-12]. However, integration remains difficult when technology is introduced without corresponding changes in curriculum, teacher preparation, infrastructure, assessment, and institutional governance.

This article therefore examines two questions: What principal challenges constrain the integration of digital journalism into the modern education system? Which development vectors can transform digital tools from channels of passive consumption into structured environments for inquiry, production, verification, and reflection? The article contributes a consolidated framework that links four integration challenges to four practical development vectors and the institutional conditions required for responsible implementation.

Review Approach and Analytical Scope

The article adopts a conceptual narrative-review approach rather than a systematic-review design. It synthesizes selected foundational works on media change and convergence; institutional reports on digital education, news consumption, and generative artificial intelligence; and scholarship on media education and journalism training in Russia and Uzbekistan. Sources were selected for their direct relevance to digital journalism, educational integration, media and information literacy, platform-based learning, and professional ethics. Because the source selection did not follow a preregistered database protocol, the conclusions should be read as an interpretive synthesis rather than an exhaustive mapping of the field.

The literature was organized through a two-part analytical framework. The first part identifies structural barriers at the levels of people, curriculum, infrastructure, and information integrity. The second part identifies development vectors in pedagogy, platform use, assessment, and artificial-intelligence literacy. This distinction prevents the discussion from treating technology itself as the solution: each digital tool is evaluated according to the learning process, professional practice, and institutional safeguards that accompany it.

Integration Challenges

Teacher Competence and Professional Development

The first challenge is uneven teacher readiness. The relevant gap is not simply technical knowledge or age-related familiarity with devices. Teachers at any career stage may be able to use a platform while lacking the pedagogical and journalistic knowledge needed to design source-based tasks, moderate publication, assess multimedia work, protect students' privacy, or respond to misinformation. Effective integration therefore requires a combination of digital competence, media-literacy pedagogy, editorial judgment, and ethical awareness [9, 10, 13]. One-off software demonstrations are insufficient because platforms and professional practices continue to change.

Professional development should be organized around authentic teaching tasks: verifying a contested claim, planning a student newsroom, producing a short podcast, editing a multimedia story, documenting permissions, and assessing evidence quality. This approach makes training transferable across tools. It also reduces dependence on a single platform and enables teachers to select technologies

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according to educational purpose rather than popularity.

Curriculum and Methodological Lag

The second challenge is the mismatch between rapidly changing media practices and slowly revised curricula. Social platforms, messaging applications, visual generators, and large language models can change within months, whereas textbooks and formal programs usually pass through longer approval cycles. A curriculum built around the operating steps of one application can therefore become obsolete quickly. The more sustainable alternative is to define stable learning outcomes: source evaluation, verification, audience analysis, multimodal composition, transparent attribution, copyright awareness, data protection, and reflection on platform influence [4-6].

Methodological guidance must also distinguish between activity and learning. Posting content does not automatically produce media literacy. Students need clear editorial briefs, evidence standards, role allocation, deadlines, feedback procedures, and criteria for revision. Without these structures, digital projects can reproduce superficial participation, plagiarism, or uncritical repetition rather than develop journalistic competence.

Digital Inequality and Access

The third challenge is unequal access to infrastructure. Multimedia production may require a reliable connection, adequate storage, microphones or cameras, editing software, and devices capable of processing audiovisual files. Differences in household income, location, disability access, and institutional resources can therefore shape who participates fully. The OECD's ecosystem perspective underscores that successful digital education depends on coordinated infrastructure, governance, resources, and human capacity rather than on devices alone [6].

Equitable integration requires low-bandwidth alternatives, shared institutional equipment, accessible formats, flexible submission options, and assignments that can be completed without requiring students to purchase particular devices or subscriptions. Educational institutions should also provide secure storage and backup procedures so that student work is not lost or controlled exclusively by commercial platforms.

Information Integrity, Platform Logic, and Generative AI

The fourth challenge concerns information integrity. Students work in an environment shaped by high-volume content, personalized recommendation systems, influencer communication, sponsored material, misinformation, and synthetic media. The Reuters Institute's reporting on digital news consumption highlights the growing importance of platforms and audience concerns about misinformation and artificial intelligence in news [7]. In this context, the central educational problem is not access to content but the ability to evaluate provenance, evidence, context, and intent.

Generative artificial intelligence intensifies this challenge because fluent text, images, audio, and video can be produced quickly without guaranteeing accuracy. UNESCO guidance stresses human agency, inclusion, privacy, transparency, and age-appropriate governance in educational use [8]. Students must therefore learn that apparent coherence is not evidence. Verification should include tracing original sources, comparing independent evidence, checking dates and metadata where available, identifying manipulated context, and documenting the use of AI tools.

Development Vectors

Project-Based Convergent Newsrooms

The first development vector is the creation of project-based convergent newsrooms within educational institutions. Media convergence combines text, photography, audio, video, graphics, and audience interaction, while professional convergence requires participants to coordinate roles across a shared production process [3, 14, 15]. A student newsroom can therefore function as a structured educational laboratory in which learners propose topics, conduct research, verify sources, divide editorial responsibilities, produce content, receive feedback, and publish revised work.

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Traditional school newspapers and radio clubs need not be discarded; they can be redesigned as components of a broader convergent system. A single investigation, for example, may result in a written article, an infographic, a short video, and a podcast discussion. The educational value lies not in multiplying formats but in requiring students to adapt evidence and narrative choices to different audiences while maintaining factual consistency and ethical standards.

Platform-Supported Production and Distribution

The second vector is the controlled use of blogs, messaging channels, podcasts, and video platforms as production and distribution environments. Online journalism scholarship in Uzbekistan has documented how internet-based media alter newsroom practices and content forms [16]. Telegram and similar messaging services can support announcements, discussion, resource sharing, feedback, and channel-based publication; early research also identified their potential for organizing e-learning communication in universities [17].

However, platform use should be governed rather than improvised. Institutions need rules for account ownership, moderation, consent, copyright, data retention, student anonymity, and the removal or correction of published material. Learning resources should be backed up outside the platform, and students should not be required to expose personal accounts. Platform metrics such as views, reactions, and comments may inform reflection on audience behavior, but they should not replace assessment of accuracy, evidence, clarity, and ethical conduct.

Multimedia Assignments and Portfolio Assessment

The third vector is the use of multimedia assignments linked to portfolio assessment. Media education is most effective when learners critically interpret media messages and create their own evidence-based media texts [9, 13]. Tasks such as multimedia longreads, explanatory videos, infographics, photo essays, and podcasts can integrate research, writing, design, teamwork, and public communication. Interactive or game-like elements may increase engagement when they serve explicit learning outcomes, but gamification should not be treated as an end in itself.

Portfolio assessment is particularly suitable because it records the production process rather than only the final artifact. A strong portfolio can include the original brief, source log, interview notes, script drafts, fact-checking record, permissions, revisions, audience reflection, and final publication. This evidence allows teachers to assess both the quality of the product and the reasoning that produced it, while helping students demonstrate skills relevant to convergent media work.

Human-Centered AI Literacy

The fourth vector is human-centered artificial-intelligence literacy. Students should learn to use large language models and visual generators as limited tools within an accountable workflow, not as substitutes for authorship or verification. Legitimate educational uses may include generating alternative headlines for critique, suggesting interview questions, transcribing audio, organizing a dataset, translating a draft for comparison, or producing a preliminary visual concept. Every use should be evaluated for accuracy, bias, privacy, copyright, and the possibility of fabricated information [6, 8].

A responsible workflow requires the student to define the task, disclose the tool and purpose, preserve relevant prompts or outputs when required, verify all factual claims against reliable sources, identify what was changed by the human author, and accept responsibility for the final product. The central professional role is therefore not an “editor of machine meanings” in an abstract sense, but an accountable author, verifier, and ethical decision-maker who understands the limits of automated systems.

Conditions for Responsible Integration

The literature reviewed in this article suggests that digital-journalism integration succeeds when pedagogical design and institutional governance develop together. Introducing a popular platform without revising learning outcomes, training teachers, supporting access, or establishing publication rules is unlikely to produce durable benefits. Conversely, even modest technology can support meaningful learning

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when students work with authentic questions, traceable sources, structured editorial roles, and transparent assessment.

Table 1. Integration challenges, development vectors, and institutional conditions

Integration challenge	Educational consequence	Development vector	Required institutional condition
Uneven teacher competence	Tools are used without adequate pedagogy, verification, or ethical supervision.	Task-based professional development and supervised newsroom practice.	Continuing training, mentoring, exemplars, and workload recognition.
Curriculum and methodological lag	Activities become platform-specific, outdated, or disconnected from learning outcomes.	Outcome-based curriculum focused on evidence, production, and reflection.	Regular curriculum review and assessment rubrics.
Digital inequality	Students have unequal opportunities to produce and submit multimedia work.	Low-bandwidth options, shared equipment, accessible formats, and flexible submission.	Infrastructure funding, technical support, and inclusive access policies.
Information-integrity and AI risks	Fluent but unreliable or manipulated content is accepted uncritically.	Fact-checking, provenance analysis, AI disclosure, and human accountability.	Publication ethics, privacy rules, source standards, and correction procedures.

Note. Author's synthesis based on the literature reviewed in [3, 6-17].

A practical implementation sequence can begin with an audit of teacher competence, infrastructure, student access, and existing publication practices. Institutions can then define a limited set of learning outcomes, train a pilot group of teachers, introduce supervised projects, and evaluate both student learning and ethical compliance. Expansion should depend on evidence from the pilot rather than on the visibility of the platform. This staged approach also makes it possible to correct unequal access, excessive workload, privacy risks, and assessment problems before the model is adopted more widely.

For Uzbekistan, integration can build on established work in media education, online journalism, and media and information literacy [10-12, 16]. The priority is not to import a single foreign platform model, but to adapt professional standards to local languages, institutional capacities, student access, and cultural expectations. Such adaptation should preserve universal journalistic principles - accuracy, independence of judgment, transparency, fairness, and accountability - while allowing institutions to select locally appropriate formats and technologies.

Conclusion

Digital journalism can strengthen modern education when it is treated as a disciplined process of inquiry, verification, creation, and responsible publication rather than as the simple use of new media tools. The main barriers are uneven teacher competence, curricular and methodological lag, digital inequality, and growing risks to information integrity. The corresponding development vectors are project-based convergent newsrooms, governed platform use, multimedia portfolio assessment, and human-centered AI literacy.

The educational contribution of digital journalism extends beyond professional preparation for media careers. It can provide students in different fields with practical media and information literacy, critical thinking, teamwork, communication, and ethical decision-making. Sustainable integration nevertheless requires institutional responsibility: updated curricula, continuing teacher development, equitable access, transparent assessment, privacy protection, correction procedures, and explicit rules for

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generative artificial intelligence. Under these conditions, digital journalism becomes a means of preparing learners to participate critically, creatively, and accountably in contemporary information environments.

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CONTENT AND LANGUAGE INTEGRATED LEARNING (CLIL) IN DEVELOPING THE LANGUAGE COMPETENCE OF BILINGUAL CHILDREN

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ABSTRACT
This small-scale exploratory study examined the use of Content and Language Integrated Learning (CLIL) with bilingual children of primary-school age. It investigated the didactic potential of CLIL for developing subject knowledge and language competence simultaneously in a non-native language. The study involved 24 children aged 7-9 and used structured classroom observation, analysis of instructional materials, pre- and post-cycle oral and written tasks, and brief consultations with two teachers. The instructional cycle comprised ten lessons organised around the CLIL 4Cs framework. Descriptive comparison indicated broader and more independent use of subject-specific vocabulary, less frequent complete reversion to the home language when difficulties arose, and greater willingness to participate in target-language communication. However, children with lower target-language proficiency sometimes experienced cognitive overload and required additional visual, gestural, or translation-based scaffolding. The findings suggest that CLIL can support functional language development in bilingual primary classrooms when tasks are differentiated and language support is carefully planned.

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Keywords: *bilingual children; primary education; subject-specific vocabulary; translanguaging; language competence.*

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Introduction

Children who grow up with two or more languages do not necessarily use those languages as separate and fully balanced systems. Their competence may vary by topic, setting, interlocutor, and communicative purpose. Consequently, educational approaches that rigidly separate language learning from subject learning may not fully reflect how bilingual children construct meaning. Bilingual education research instead emphasises the value of connecting linguistic development with cognitively meaningful classroom activity (Cummins, 2000; García, 2009).

Content and Language Integrated Learning (CLIL) offers one way to create this connection. CLIL emerged as a European umbrella term in the 1990s and expanded through multilingual education initiatives (Marsh, 2002; Pérez-Cañado, 2012). In CLIL, a foreign or additional language is used as a medium for learning curriculum content rather than being treated only as an independent school subject. The approach is commonly organised through the 4Cs framework: Content, Communication, Cognition, and Culture (Coyle et al., 2010). However, CLIL is not a single uniform model, and its boundaries in relation to immersion and other forms of bilingual education remain debated (Cenoz et al., 2014; Lasagabaster &

Sierra, 2010). For bilingual children, CLIL may be especially relevant because it resembles their everyday experience of using several linguistic resources while learning about the world.

At the same time, the use of CLIL in a bilingual classroom raises specific pedagogical questions. Children may understand a concept in one language but lack the vocabulary to express it in another. They may also combine languages strategically rather than remain within a single target-language code. Such mixed practices can be interpreted as translanguaging: the purposeful use of a learner's full linguistic repertoire to construct meaning and participate in learning (García & Li Wei, 2014). A productive CLIL design must therefore develop target-language competence without treating every cross-linguistic resource as a failure.

The present study examined a bilingual primary-school group in which Uzbek and Russian were the most common language combination and English was introduced as an additional language. Its aim was to explore how a short CLIL cycle influenced children's use of subject-specific vocabulary, independent language production, and willingness to communicate, while also identifying implementation difficulties reported by teachers.

The study addressed the following research questions:

1. How did children's use of subject-specific vocabulary and independently produced target-language utterances change across the CLIL lesson cycle?
2. How did children use their available languages when they encountered communicative difficulty during CLIL tasks?
3. What instructional difficulties did teachers identify when preparing and delivering CLIL lessons for a linguistically uneven group?

Methods

Research design and participants

The study used a small-scale exploratory pre-post observational design conducted over one academic term. The participant group comprised 24 children aged 7-9 who displayed early bilingualism, predominantly in Uzbek and Russian, with varying additional exposure to English. The study did not include a control group; therefore, the analysis was intended to identify classroom patterns rather than establish causal effects.

Instructional cycle

The instructional cycle consisted of ten CLIL-based lessons planned around Content, Communication, Cognition, and Culture (Coyle et al., 2010), with scaffolding principles informed by practical CLIL guidance (Mehisto et al., 2008). Subject content and language objectives were addressed within the same activities. For example, the water cycle was taught as science content rather than as an isolated vocabulary lesson. Terms such as evaporation, condensation, and precipitation were introduced in English through diagrams, teacher modelling, guided questioning, and a hands-on activity involving water and ice. Visual support and repeated contextual use were intended to make the language comprehensible without reducing the conceptual content of the lesson.

Data collection

Structured classroom observation was guided by three predetermined indicators: the frequency with which children used subject-specific vocabulary in the target language, the contextual accuracy of that vocabulary, and the extent to which utterances were produced independently rather than repeated verbatim after the teacher. Observations also recorded how readily children shifted between languages when they encountered difficulty.

Short oral and written tasks were administered at the beginning and end of the ten-lesson cycle. These tasks required children to retell the lesson topic in their own words, answer content questions, and write captions for illustrations. The initial and final responses were compared descriptively across the three observation indicators. In addition, brief consultations were held with the two teachers who worked with

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the group to record their impressions of changes in participation and the difficulties involved in preparing bilingual materials.

Analytical approach

The classroom records and task samples were reviewed for directional changes across the lesson cycle. The analysis focused on whether subject-specific vocabulary became more frequent and contextually appropriate, whether target-language contributions became more independent, and whether children relied differently on their home languages when communication became difficult. Teacher comments were used as supplementary evidence for interpreting observed participation and instructional constraints. Because the study was exploratory and the sample was small, no inferential statistical claims were made.

Results

Development of subject-specific vocabulary

Comparison of the initial and final tasks indicated a clear qualitative expansion in subject-specific vocabulary. At the beginning of the cycle, children commonly relied on everyday words, gestures, or broad descriptions when explaining natural processes. In the final tasks, many children independently used central target-language terms and linked them more directly to the relevant concepts. Pronunciation and word order remained inconsistent in some responses, but the vocabulary was generally used with greater functional relevance than at the start of the cycle.

Use of multiple languages and classroom participation

A second pattern concerned children's responses to communicative difficulty. In the initial lessons, difficulty often led to a complete return to the stronger home language. Later in the cycle, children more frequently maintained the subject term in English while constructing the surrounding grammatical frame in Uzbek or Russian. These mixed utterances were treated as transitional meaning-making strategies rather than as simple errors. They enabled children to sustain participation while gradually extending target-language use.

The teachers also reported that children appeared less anxious about speaking inaccurately during content-focused activities. When attention was directed towards solving a subject problem, such as explaining how rain forms, children were more willing to contribute orally than when the main purpose of the activity was grammatical correctness. This change was observational and should not be interpreted as a standardised measure of anxiety or motivation.

Instructional difficulties

The main difficulty was the uneven language competence within the group. Children with lower target-language proficiency sometimes experienced cognitive overload when they were expected to understand a new concept and unfamiliar vocabulary simultaneously. Teachers therefore had to vary the level of support, use additional visual and gestural cues, allow strategic translation, and simplify explanations without distorting the subject content. Preparing materials that maintained this balance required additional teacher time and subject-language coordination.

Discussion

The findings suggest that CLIL can create meaningful conditions for language development because vocabulary is attached to a concrete conceptual task rather than presented as an isolated list. Research across European CLIL contexts has reported potential language benefits while also stressing that outcomes depend on programme design, exposure, teacher expertise, and learner characteristics (Ruiz de Zarobe & Jiménez Catalán, 2009; Pérez-Cañado, 2012). This interpretation is consistent with the 4Cs model, in which communication supports the learning of content and cognition rather than functioning as a separate objective (Coyle et al., 2010). In the present group, children's growing use of subject-specific terms appeared to be connected to repeated contextual exposure, visual support, and the need to explain a real process.

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The mixed Uzbek-, Russian-, and English-language utterances also require careful interpretation. Research on CLIL classroom discourse shows that learners construct subject knowledge through interaction and may draw on partial or mixed linguistic resources while doing so (Dalton-Puffer, 2007; Nikula et al., 2013). From a monolingual perspective, such utterances might be classified only as incomplete target-language performance. From a bilingual perspective, however, they can function as scaffolds that preserve meaning and participation while new linguistic resources are developing. This pattern accords with translanguaging theory, which views bilingual speakers' repertoires as integrated resources for learning rather than as isolated systems that must always be kept separate (García & Li Wei, 2014). The instructional goal is not to make mixed language permanent, but to use it strategically as a bridge towards more independent target-language production.

The results also support the need for differentiation. Bilingual children rarely have identical competence across all of their languages or across all subject domains. Cummins (2000) distinguishes conversational fluency from the language required for academic learning, while García (2009) emphasises the variable and socially situated nature of bilingual competence. Research on the roles of language in CLIL further shows that academic subjects require distinctive genres, registers, and ways of explaining knowledge (Llinares et al., 2012). In practice, a child who communicates confidently in everyday English may still need explicit support with the vocabulary and discourse patterns required to explain a scientific process. CLIL teachers therefore need to plan both the conceptual demand and the linguistic demand of each task.

Teacher preparation is central to this process. Effective CLIL materials must be conceptually accurate, linguistically accessible, and flexible enough to support different language profiles (Mehisto et al., 2008). Visuals, demonstrations, sentence frames, guided questions, and strategically permitted translation can reduce unnecessary language barriers. However, excessive simplification may weaken subject learning, whereas insufficient scaffolding may overload learners. The method consequently requires teachers to coordinate subject knowledge, language pedagogy, and formative observation rather than merely translate an existing lesson into English.

Limitations

The study has several limitations. It involved one group of 24 children, used no control or comparison group, and covered only a ten-lesson cycle within one academic term. The outcomes were analysed descriptively, and the report provides no standardised language-proficiency scores or inferential statistics. Teacher perspectives were obtained through brief consultations rather than a formally validated interview protocol. The findings may also reflect the selected topic, the teachers' individual practices, and the specific language profiles of the participating children. They should therefore be interpreted as exploratory evidence rather than as proof of the long-term effectiveness of CLIL.

Further research should use larger samples, longer observation periods, clearly documented proficiency measures, and comparison groups receiving separate language and subject instruction. This is particularly important because CLIL varies substantially across settings and should not be treated as a single standardised intervention (Cenoz et al., 2014; Lasagabaster & Sierra, 2010). Quantitative measures could be combined with detailed qualitative analysis of classroom interaction to examine when translanguaging supports learning and when additional target-language scaffolding is required.

Conclusion

This exploratory study indicates that CLIL can support the development of language competence among bilingual primary-school children when language learning is embedded in meaningful subject activity. Across the ten-lesson cycle, children showed broader and more independent use of subject-specific vocabulary, greater willingness to remain engaged when linguistic difficulties occurred, and increased use of mixed-language strategies to sustain communication. These patterns do not establish a

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causal effect, but they demonstrate the pedagogical value of linking content, cognition, and communication in a multilingual classroom.

The method is most effective when teachers differentiate support according to children's language profiles and treat cross-linguistic resources as temporary scaffolds rather than automatic errors. In the multilingual classrooms of Uzbekistan, CLIL may therefore provide a practical framework for developing subject knowledge and functional competence in an additional language, provided that teacher preparation, material design, and ethical research reporting are addressed carefully.

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IMPROVING ASSESSMENT COMPETENCIES IN PRIMARY SCHOOL TEACHERS: PEDAGOGICAL APPROACHES AND INNOVATIONS

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ABSTRACT

This mixed-methods study examined primary school teachers' assessment competencies, with particular attention to formative assessment, digital assessment tools, culturally responsive practices, and professional development. The quantitative component analyzed survey responses from approximately 100 teachers working in urban, suburban, and rural school settings, while qualitative evidence was obtained from open-ended responses and follow-up interviews or focus groups with a purposively selected subset of participants. Descriptive findings showed that 85% of teachers reported using formative assessment regularly; verbal questioning (92%), classroom observation (75%), and peer feedback (68%) were the most common practices. However, 45% reported difficulty using assessment evidence to adjust instruction. Only 40% felt confident using digital tools for data analysis, and consistent implementation of culturally responsive assessment was reported by 36%. Teachers who had access to ongoing professional development reported substantially greater confidence in assessment design and implementation than those without such support (78% versus 45%). The findings indicate that assessment competency depends not only on teachers' knowledge of techniques but also on sustained professional learning, collaboration, time, resources, and institutional support. The article recommends practice-based training in formative assessment, digital assessment literacy, culturally responsive design, and collaborative analysis of student evidence.

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Keywords: *assessment competency, primary school teachers, formative assessment, digital assessment, culturally responsive assessment, professional development, learning analytics, reflective practice.*

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Introduction

Assessment is not merely a mechanism for assigning grades; it is a central component of teaching and learning. In primary education, teachers use assessment evidence to identify what pupils understand, diagnose misconceptions, adapt instruction, provide feedback, and determine whether intended learning outcomes have been achieved. These tasks require assessment competency: the knowledge and practical ability to select, design, administer, interpret, and use assessment information appropriately and fairly.

The need for strong assessment competency has increased as primary classrooms have become more diverse and as schools have adopted competency-based curricula, digital platforms, and more personalized approaches to learning. Traditional paper-and-pencil tests remain useful for some purposes, but they cannot by themselves provide the continuous, contextual, and actionable evidence required for responsive teaching. Formative assessment, performance tasks, portfolios, peer and self-assessment, digital quizzes, and learning analytics can broaden the evidence available to teachers. Their value, however,

depends on whether teachers can align them with learning goals and interpret the resulting information accurately.

Previous scholarship has established the importance of formative assessment and feedback, but it has also warned against treating every classroom test as automatically formative. Assessment becomes formative only when evidence is used to make decisions that improve ongoing teaching and learning (Bennett, 2011; Black & Wiliam, 1998; Wiliam, 2011). In addition, equitable assessment requires sensitivity to pupils' cultural and linguistic backgrounds, while digital assessment requires technical competence and attention to privacy and ethical use of data.

The present study investigated the assessment practices and professional learning needs of primary school teachers. It addressed three research questions: (1) Which assessment practices are most commonly used by primary school teachers? (2) What barriers limit the effective use of formative, digital, and culturally responsive assessment? and (3) How are professional development and teacher collaboration associated with confidence in assessment practice?

Literature Review

Assessment literacy and formative assessment

Assessment literacy includes an understanding of assessment purposes, task design, validity, reliability, interpretation, feedback, and the consequences of assessment decisions. Popham (2009) argues that assessment literacy is a fundamental professional requirement because weak assessment decisions can distort both teaching and judgments about pupil learning. In primary classrooms, assessment literacy is especially important because teachers gather evidence through multiple informal and formal sources, including observation, questioning, written work, discussion, and short performance tasks.

Formative assessment is most effective when teachers clarify learning intentions, elicit evidence of understanding, provide feedback that helps pupils move forward, and adapt instruction in response to that evidence (Black & Wiliam, 1998; Heritage, 2010; Wiliam, 2011). Feedback is most useful when it addresses the task, the learning process, and the learner's next steps rather than offering only praise or grades (Hattie & Timperley, 2007). Meta-analytic evidence suggests that formative assessment can improve achievement, although effects vary by subject, implementation quality, and study design; therefore, claims of uniformly large effects should be avoided (Kingston & Nash, 2011).

Alignment and backward design

Assessment quality also depends on alignment. In backward design, teachers first identify the desired learning outcomes, then determine acceptable evidence of learning, and only afterward plan teaching activities (Wiggins & McTighe, 2005). This sequence helps prevent a common problem in which classroom activities are engaging but the assessment does not measure the intended knowledge or skills. For primary school teachers, backward design can strengthen the coherence of lessons, success criteria, feedback, and summative judgments.

Culturally responsive assessment

Assessment can disadvantage pupils when tasks assume cultural knowledge, language practices, or modes of expression that are not equally familiar to all learners. Culturally responsive teaching recognizes pupils' backgrounds as resources for learning rather than as deficits (Gay, 2018; Ladson-Billings, 1994). Culturally responsive assessment therefore involves reviewing task language for unnecessary bias, allowing appropriate alternative ways to demonstrate learning, and interpreting performance in relation to pupils' linguistic and cultural experiences. Teacher preparation should integrate these principles systematically rather than treating them as optional additions (Villegas & Lucas, 2002).

Digital assessment and learning analytics

Digital tools can provide rapid feedback, automate parts of scoring, store evidence over time, and support the identification of patterns in pupil participation and performance. Learning analytics extends this capacity by using data from digital environments to support educational decisions (Siemens, 2013).

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Nevertheless, the educational value of technology depends on teachers' ability to interpret data and connect it to instructional action. Digital assessment also raises concerns about privacy, data ownership, unequal access, and overreliance on platform-generated indicators (Selwyn, 2016; Siemens, 2013).

Professional development and reflective collaboration

Assessment competency develops through sustained practice rather than isolated workshops. Effective professional development is content-focused, active, collaborative, supported by models and coaching, and sustained over time (Darling-Hammond et al., 2017). Reflective practice enables teachers to examine how their assessment choices affect learning and to revise those choices in light of evidence (Schön, 1983). Collaborative lesson analysis and professional learning communities can make this process more systematic by allowing teachers to compare tasks, review pupil work, and discuss scoring and feedback (Stigler & Hiebert, 1999; Timperley, 2008).

Materials and Methods

Research design and participants

The study used a cross-sectional mixed-methods design. The quantitative component consisted of approximately 100 completed questionnaires from primary school teachers working in urban, suburban, and rural educational settings. Stratified sampling was used to include teachers with different levels of experience, grade assignments, and school contexts. The qualitative component consisted of open-ended questionnaire responses and follow-up semi-structured interviews or focus groups with a purposively selected subset of the survey participants.

Instrument and data collection

The questionnaire examined four domains: the frequency of formative assessment practices; the use of digital assessment tools; awareness and implementation of culturally responsive assessment; and access to professional development and collaborative learning. Closed-ended items used categorical responses and Likert-type scales, while open-ended items invited participants to describe barriers and professional learning needs. Follow-up interviews and focus groups explored how teachers used assessment evidence, how they interpreted digital data, and what support they needed to design inclusive assessments.

Data analysis

Closed-ended responses were summarized using frequencies and percentages. Because the study was descriptive, differences between groups are reported as percentage contrasts rather than as causal effects. Open-ended responses and interview or focus-group data were reviewed thematically. Recurring themes were organized around assessment use, instructional decision-making, digital confidence, cultural responsiveness, professional development, and institutional barriers.

Results

Use of formative assessment

Most respondents (85%) reported using formative assessment regularly. Verbal questioning was the most common strategy (92%), followed by classroom observation (75%) and peer feedback (68%). These figures indicate that teachers frequently gathered evidence during instruction. However, 45% reported difficulty using the evidence to make timely changes to teaching, suggesting a gap between collecting information and interpreting it for instructional action.

Digital assessment practices

Teachers generally viewed digital assessment positively, but only 40% felt confident using digital tools for meaningful data analysis. Many participants reported using technology primarily to administer or score summative tasks rather than to support ongoing formative decisions. Concerns about privacy and security were reported by 31%, while 28% indicated that they had not received sufficient training to integrate digital tools effectively into classroom assessment.

Culturally responsive assessment

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Awareness of culturally responsive assessment was reported by 55% of participants, but only 36% said that they implemented such practices consistently. Teachers who used culturally responsive approaches most often provided multiple modes for pupils to demonstrate learning, such as oral explanations, visual projects, and written responses. Nevertheless, 63% were uncertain about how to design assessments that reflected pupils' cultural and linguistic backgrounds while maintaining clear academic expectations.

Professional development and collaboration

Access to ongoing professional development was descriptively associated with greater confidence. Among teachers who reported participating in sustained professional learning, 78% felt confident designing and implementing different forms of assessment, compared with 45% of those without such support. At the same time, 39% reported that assessment-focused professional development was infrequent or unavailable.

Collaboration also appeared beneficial. Among teachers who participated in professional learning communities, 62% reported that peer discussion and feedback improved their assessment practices. However, only 30% indicated that their schools regularly organized assessment-focused collaboration. These findings suggest that the perceived value of collaboration exceeded the opportunities available to engage in it.

Table 1. Summary of reported assessment practices, barriers, and support

Domain	Indicator	Reported proportion
Formative assessment	Regular use	85%
Formative assessment	Verbal questioning	92%
Formative assessment	Classroom observation	75%
Formative assessment	Peer feedback	68%
Instructional use	Difficulty using evidence to adjust teaching	45%
Digital assessment	Confidence in digital data analysis	40%
Digital assessment	Privacy or security concerns	31%
Cultural responsiveness	Awareness of culturally responsive assessment	55%
Cultural responsiveness	Consistent implementation	36%
Cultural responsiveness	Uncertainty about inclusive task design	63%
Professional development	Confidence with ongoing support	78%
Professional development	Confidence without ongoing support	45%
Professional development	Infrequent or unavailable opportunities	39%
Collaboration	PLCs improved assessment practice	62%
Collaboration	Schools regularly facilitated collaboration	30%
Barrier	Time constraints	58%
Barrier	Large class sizes	52%
Barrier	Insufficient training in data interpretation	46%
Barrier	Insufficient resources	41%

Discussion

The findings indicate that primary school teachers commonly use formative techniques but do not always convert the resulting evidence into instructional decisions. This distinction is central to the literature: an assessment activity is formative only when its evidence changes what teachers or pupils do next (Black & Wiliam, 1998; Heritage, 2010; Wiliam, 2011). The high use of questioning and observation therefore represents a useful foundation, but the reported difficulty with data interpretation shows that frequency alone is not an adequate indicator of quality.

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The results also support Bennett's (2011) caution that formative assessment is not a single standardized intervention. Its impact depends on task quality, domain knowledge, feedback, timing, and teacher support. The present data suggest that professional development should focus less on lists of assessment techniques and more on decision cycles: clarifying intended learning, eliciting evidence, interpreting patterns, selecting a response, and checking whether the response improved learning. Backward design can strengthen this cycle by aligning tasks and success criteria with intended outcomes (Wiggins & McTighe, 2005).

Digital assessment presented a similar pattern. Teachers were interested in digital tools but less confident in interpreting data or addressing privacy concerns. Learning analytics can make patterns visible, yet dashboards and automated scores do not replace professional judgment (Siemens, 2013). Teachers need opportunities to practice translating digital indicators into pedagogically appropriate actions and to examine the ethical implications of data collection, access, and retention (Selwyn, 2016).

The gap between awareness and consistent use of culturally responsive assessment is also important. Providing multiple modes of response can improve access, but cultural responsiveness requires more than offering alternative formats. Teachers must examine whether task content, language, scoring criteria, and assumptions about participation create unnecessary barriers. The findings therefore reinforce calls to integrate cultural and linguistic responsiveness into teacher preparation and professional learning (Gay, 2018; Villegas & Lucas, 2002).

Finally, the descriptive contrast between teachers with and without ongoing professional development is consistent with evidence that sustained, collaborative, practice-based learning is more useful than isolated workshops (Darling-Hammond et al., 2017; Timperley, 2008). Professional learning communities can support moderation of pupil work, joint task design, and reflective inquiry, but the low proportion of schools facilitating regular collaboration suggests that institutional structures remain insufficient.

Implications for Practice

1. **Strengthen formative decision-making.** Professional development should require teachers to analyze samples of pupil work, identify misconceptions, select instructional responses, and evaluate whether those responses were effective.
2. **Develop digital assessment literacy.** Training should include not only platform operation but also data interpretation, privacy, accessibility, and the appropriate combination of digital and non-digital evidence.
3. **Integrate culturally responsive design.** Teachers should review task language, contexts, response formats, and scoring criteria for avoidable cultural or linguistic bias while preserving the intended learning standard.
4. **Create sustained collaborative structures.** Schools should allocate regular time for teachers to co-design assessments, moderate scoring, discuss feedback, and examine patterns in pupil learning.
5. **Align assessment with curriculum goals.** Backward design should be used to connect intended outcomes, success criteria, assessment tasks, teaching activities, and feedback.

Limitations and Future Research

The study relied primarily on self-reported practices and descriptive percentages; consequently, it cannot establish that professional development caused greater assessment confidence or improved pupil outcomes. The study also did not include direct classroom observation, independent evaluation of assessment quality, or measures of pupils' achievement. Future research should combine surveys with observation, assessment-artifact analysis, and longitudinal measures of teacher practice and pupil learning. It should also report the size and composition of the qualitative sample in full and examine whether findings differ by school location, teaching experience, grade level, and access to digital infrastructure.

Conclusion

Improving assessment competency in primary school teachers requires more than expanding the number of tools they use. Teachers must be able to align assessment with learning goals, interpret evidence, provide actionable feedback, design inclusive tasks, and use digital data responsibly. The study found widespread use of formative techniques but persistent difficulties in converting evidence into instructional action. It also identified gaps in digital confidence, culturally responsive task design, professional development, and

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structured collaboration. Sustained, practice-based professional learning and school-level support are therefore essential for turning assessment from a record of learning into a mechanism for improving learning.

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DEVELOPING A HEALTHY LIFESTYLE CULTURE AMONG FUTURE PHYSICAL EDUCATION TEACHERS: NATIONAL PRACTICE AND INTERNATIONAL EXPERIENCES

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ABSTRACT
This article examines the current state of efforts to develop a healthy lifestyle culture among future physical education teachers and analyzes relevant international experience. It argues that future physical education teachers should be prepared not merely as specialists capable of meeting prescribed physical standards, but also as personal role models and active advocates of healthy and physically active lifestyles for their students. Drawing on advanced practices from developed countries, the article offers practical recommendations for strengthening the personal and professional health culture of prospective physical education teachers.

ACCEPTED

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Keywords: *future physical education teachers, healthy lifestyle culture, international experience, professional health, personal role model, physical education.*

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Introduction

Under contemporary conditions of globalization, human health and the attainment of physical and spiritual well-being are increasingly regarded as important determinants of social development. In particular, the development of a healthy lifestyle culture among future teachers has become a priority area in pedagogy and psychology. This emphasis reflects the fact that teachers are not only providers of knowledge but also influential role models who can promote healthy ways of living among their students.

A healthy lifestyle culture can be understood as a system of knowledge, skills, and values directed toward preserving an individual's physical, psychological, spiritual, and social health. It encompasses such dimensions as balanced nutrition, regular physical activity, personal hygiene, stress management, the avoidance of harmful habits, and the effective organization of time. Developing this culture among prospective teachers in institutions of pedagogical education contributes to the healthy and well-rounded development of future generations.

Higher education institutions currently devote considerable attention to shaping students' attitudes toward healthy living. Physical education classes, sports clubs, health-promotion activities, psychological training, and preventive initiatives are increasingly incorporated into university life. At the same time, the integration of health-preserving technologies into the educational process has become an important institutional objective.

Physical education teachers are among the principal agents responsible for promoting healthy and active lifestyles in educational settings. When teachers themselves do not model sound nutrition, regular physical activity, injury prevention, and effective stress management, their capacity to influence students through personal example is weakened. It is therefore essential to develop both personal and professional dimensions of healthy lifestyle culture among future physical education teachers during their university education.

KEY DIMENSIONS OF HEALTHY LIFESTYLE CULTURE IN TEACHER EDUCATION

In pedagogical higher education institutions, the healthy lifestyle culture of future teachers is developed through several interrelated areas:

- health promotion through physical education and sport;
- the development of medical and hygienic knowledge;
- the strengthening of psychological resilience;
- the enhancement of moral and ethical education;
- the development of ecological awareness; and
- the cultivation of a responsible attitude toward personal health.

Contemporary research indicates that many university students experience declining levels of physical activity, excessive use of the internet and digital technologies, unhealthy eating practices, and heightened stress. These factors adversely affect their overall well-being. Because teaching is associated with considerable emotional demands, the development of stress tolerance and psychological resilience among prospective teachers is particularly important.

The concept of health-preserving pedagogy is now widely applied in educational institutions. Its central purpose is to safeguard students' physical and psychological health throughout the educational process. Effective implementation requires cooperation among teachers, psychologists, medical professionals, and parents.

National values also play an important role in developing a healthy lifestyle culture among future teachers. In longstanding Uzbek traditions, cleanliness, personal hygiene, moderation in eating, respect for elders, and engagement in physical work have been regarded as integral components of a healthy way of life. Integrating these values into contemporary educational content can increase the effectiveness of educational and character-development activities.

Pedagogical and psychological factors are equally important in this process. First, students must develop a conscious and responsible attitude toward health. Motivation, personal example, and practical activity are central instruments for achieving this objective.

From a psychological perspective, adherence to a healthy lifestyle depends on an individual's internal needs and value system. When students understand health as one of their most important assets, they are more likely to organize their behavior accordingly. The educational process should therefore address the following tasks:

- developing positive motivation;
- strengthening self-monitoring skills;
- teaching effective stress-management strategies;
- cultivating volitional qualities; and
- creating a healthy psychological climate within the group.

Interactive methods for developing a healthy lifestyle culture are also considered effective in pedagogical research. Training sessions, case studies, role-playing activities, sports competitions, debates, and project-based work encourage students' active participation and facilitate the development of practical competencies.

UNESCO distinguishes three interrelated components of health: physical or somatic health, psychological health, and spiritual health. Health may therefore be understood as a complex and

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multidimensional concept that encompasses different aspects of human life while also reflecting individual characteristics.

Throughout the historical development of medical and scientific knowledge, the study of health gradually emerged as a distinct field concerned with understanding human capabilities and the reserve capacities of the organism.

HEALTHY LIFESTYLE CULTURE IN EASTERN SOCIETIES

Healthy lifestyle culture in Eastern societies is commonly characterized by the following features:

- the integration of spirituality and health;
- strict observance of discipline and daily routines;
- reliance on national traditions;
- the priority accorded to collectivism and family education;
- strong emphasis on prevention; and
- a way of life oriented toward harmony with nature.

Within these societies, health is approached not only as a physical condition but also as a psychological and spiritual state. Elements of Eastern experience can be adapted to the national education system in the following areas:

- developing discipline and regular daily routines among young people;
- promoting healthy living on the basis of national values;
- increasing physical activity;
- strengthening psychological resilience;
- advancing a preventive medical culture; and
- developing healthy eating habits.

NATIONAL PRACTICE IN UZBEKISTAN

These approaches also have practical relevance in Uzbekistan. Presidential Decree No. PF-6099, “On Measures to Widely Introduce a Healthy Lifestyle and Further Develop Mass Sports,” constitutes an important legal foundation for national work in this area. The decree provides for the following measures:

- organizing mass-sport activities in government institutions;
- introducing weekly sports sessions;
- establishing a monitoring system through the “Healthy Lifestyle” platform; and
- implementing measures intended to reduce excess weight, physical inactivity, and harmful habits.

Development of Mass Sports

Uzbekistan is currently expanding sports and health-related infrastructure, including sports grounds, outdoor workout areas, youth sports schools, fitness facilities, and health-promotion centers. Schools, colleges, and higher education institutions regularly organize sports competitions, marathons, and health-promotion campaigns. The presidential decree also provides for weekly sports sessions and mass competitions.

Development of a Healthy Eating Culture

Considerable attention is being given to promoting healthy eating among the population. State programs identify several priorities: reducing the consumption of foods high in salt, sugar, and fat; limiting fast-food consumption; increasing the consumption of vitamin-rich foods; and promoting balanced diets. Government organizations and educational institutions also conduct seminars and public-awareness activities on healthy nutrition.

Healthy Lifestyle Culture in Youth Education

Schools and higher education institutions implement physical education classes, sports clubs, the “From Childhood to Sport” program, morning exercise initiatives, and the “Fun Starts” program. These

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activities contribute to the development of physical activity, discipline, volitional qualities, and healthy living skills among young people.

An Approach Based on National Values

In Uzbekistan, healthy lifestyle culture is developed in harmony with national and spiritual values. Particular emphasis is placed on cleanliness, personal hygiene, moderation in eating, family education, collectivism, and respect for sport. Cooperation among the mahalla, the family, and educational institutions is especially important in this process.

The development of a healthy lifestyle culture in Uzbekistan is therefore pursued through a comprehensive and systematic approach. State policy, the education system, mass sports, preventive medicine, and national values operate in combination to strengthen public health. Teaching young people to adopt healthy lifestyles and supporting their physical and spiritual development are regarded as important conditions for national progress.

INTERNATIONAL EXPERIENCE

In developed countries, the preparation of future teachers on the basis of healthy lifestyle culture is also supported at the level of public policy. International experience demonstrates several potentially effective approaches.

Finland

The Finnish education system places particular emphasis on student health. Educational processes are organized according to principles of humanism and psychological comfort. In teacher education institutions, prospective teachers take specialized courses in stress management, emotional intelligence, healthy communication, and physical activity.

Psychological services are established in Finnish educational institutions, and students' emotional well-being is monitored on a regular basis. Outdoor learning, walking, and sports activities are also regarded as integral components of the educational process.

Japan

In Japan, healthy lifestyle culture is closely integrated with discipline and collective responsibility. Schools and higher education institutions regularly organize morning physical exercise. From an early age, students acquire habits related to cleanliness, effective time management, and cooperation within the group.

The Japanese education system prioritizes the principle of "education for life," through which health preservation is taught in connection with everyday behavior. Prospective teachers participate in practical activities addressing healthy nutrition, psychological resilience, and work culture.

United States

Wellness education programs are widely developed in universities in the United States. These programs are intended to strengthen students' physical, psychological, and social well-being in an integrated manner. Universities provide fitness centers, psychological counseling services, and specialized wellness clubs.

Students enrolled in teacher education programs are offered seminars on stress management, the prevention of professional burnout, and the development of emotional resilience. Such training constitutes an important form of preparation for their future professional activity.

Germany

Germany places strong emphasis on practical activity in the development of healthy lifestyle culture. Students participate actively in sports clubs, tourism, and environmental projects. In teacher education institutions, health pedagogy is taught as a distinct academic subject.

A particularly important feature of the German approach is the close relationship established between education and health. Students' daily routines, eating practices, and physical activity are organized on a scientific basis.

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IMPLICATIONS FOR THE NATIONAL TEACHER EDUCATION SYSTEM

Analysis of international experience indicates that a comprehensive approach is essential for developing a healthy lifestyle culture among future teachers. Relevant practices may be adapted to the national education system through the following measures:

- introducing a dedicated course on healthy lifestyle culture more widely into teacher education curricula;
- strengthening psychological support services for university students;
- developing sports and health-promotion infrastructure;
- organizing training in stress management and emotional intelligence;
- applying health-preserving technologies throughout the educational process; and
- promoting healthy living on the basis of national values.

The development of a culture of moderate and responsible digital-technology use in educational institutions is also an urgent task. Excessive information exposure and physical inactivity can have adverse effects on young people's health.

Preparing future teachers on the basis of a healthy lifestyle culture is one of the important responsibilities of a modern education system. Healthy lifestyle culture supports not only the protection of physical health but also spiritual, psychological, and social stability.

Although pedagogical education institutions currently undertake a range of activities in this area, there remains a need to study international experience more systematically and adapt it to national conditions. Practices from Finland, Japan, the United States, and Germany indicate that comprehensive and innovative approaches can be effective in developing a healthy lifestyle culture.

Consequently, the preparation of future teachers should ensure the integration of physical, psychological, and spiritual education, the broader application of health-preserving technologies, and the promotion of healthy living grounded in national values.

Within higher education, particular attention should be devoted to theoretical and practical activities that increase the physical activity of future physical education teachers, develop healthy eating habits, support appropriate work-rest routines, encourage the avoidance of harmful habits, and strengthen psychological resilience. Such preparation will help them become competent professionals capable of promoting healthy lifestyles in their future careers.

The application of technologies designed to develop a healthy lifestyle can strengthen students' fundamental personal characteristics, including their desire for knowledge and self-understanding, higher-order needs, and value-based attitudes. These technologies can also help students reassess the meaning of their lives, pursue achievement and recognition, realize their abilities, and respond constructively to the need for lifestyle change. Diagnostic assessment activities can further strengthen motivation for participation in physical education and support the development of sustainable healthy-lifestyle skills.

CONCLUSION

In conclusion, the development of healthy lifestyle competencies among future physical education specialists is of considerable importance. Through physical activity, balanced nutrition, the avoidance of harmful habits, and effective stress management, these specialists should serve as both role models and advocates of healthy living who contribute to public health and the development of well-rounded individuals. Achieving this objective requires the effective integration of theory, practice, and personal example.

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INSTITUTIONAL FOUNDATIONS AND GOVERNANCE MECHANISMS FOR DEVELOPING THE HUMAN CAPITAL OF GIFTED YOUTH IN UZBEKISTAN

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ABSTRACT
This article examines the formal institutional design of Uzbekistan's system for identifying, developing, and supporting gifted youth. A structured qualitative document analysis was conducted using seven core national legal instruments in force on 1 January 2026, together with official institutional sources. The analysis maps four principal institutional actors, a coordinating layer, and an adjacent public-administration actor across five functions: identification, development, transition to foreign education, return and professional utilization, and information management. Five governance risks are identified at the level of regulatory design: overlapping eligibility routes for overseas support, fragmented information resources, unevenly specified responsibility during the school-to-university transition, weak continuity provisions for pupils who leave specialized institutions, and the absence of a shared system-level accountability framework. The article corrects two common interpretive errors. The statutory ratio of 1:15 applies to school advisers assigned to National Programme participants, whereas the 14 chief advisers coordinate adviser activity at regional level; the two groups cannot be used to calculate a 107:1 workload. Likewise, the annual quota of 200 places from 2027 equals 13.3% of the maximum annual Grade 9 intake of 1,500 only as a nominal ratio, not as an observed transition rate. A staged governance model is proposed: clarify priority and continuity rules, establish a data-exchange protocol based on a single participant identifier, and introduce shared outcome indicators. The findings concern de jure institutional design and require subsequent empirical validation.

ACCEPTED

02.08.26

Keywords: *gifted youth; institutional analysis; horizontal governance; human capital; inter-agency coordination; Uzbekistan.*

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1. Introduction

The development of gifted young people is inherently cross-sectoral. Identification normally begins in school, but the relevant trajectory may later include specialized education, international examinations, admission to foreign universities, scholarship financing, return obligations, employment, and long-term professional development. No single institution can govern this entire trajectory effectively without structured links to other institutions. The policy field therefore has the characteristics of a horizontal or cross-cutting governance domain: responsibilities are distributed among organizations that operate under different legal mandates, budgets, reporting lines, and information systems.

Uzbekistan has substantially expanded its institutional capacity in this field since 2019. Presidential Schools were formalized through a dedicated regulatory framework; the Agency for Youth Affairs was established in 2020; the network and regulation of specialized schools were expanded in 2022; and major reforms in 2025 reorganized the El-yurt umidi Foundation and introduced the President's Gifted Children initiative and its National Programme. These reforms created substantial capacity for early identification, specialized instruction, overseas education, and the return of scholarship holders. At the same time, institutions created through separate instruments do not automatically operate as a single system. Integration requires explicit rules on responsibility, priority, information exchange, continuity, and shared outcomes.

The governance problem examined in this article is therefore not whether individual institutions possess useful mandates. The central question is whether the formal rules connect the stages of the gifted-youth trajectory into a coherent institutional pathway. A system may contain strong organizations and generous instruments while still producing gaps at the boundaries between them. Such gaps may appear when two institutions are authorized to support similar candidates without a priority rule, when each organization maintains its own information resource, or when the formal responsibility of one actor ends before another actor's responsibility begins.

The article has three objectives. First, it maps the principal actors and the functional distribution of their mandates. Second, it identifies governance risks that arise from omissions, overlaps, or weak connections in the formal regulatory design. Third, it proposes an implementable integration model and a set of indicators that can later be populated with administrative data. The study does not claim to measure actual implementation, candidate behavior, institutional performance, or employment outcomes. It examines the de jure architecture in force on 1 January 2026 and treats identified gaps as hypotheses and formal design risks that require empirical verification.

Three research questions guide the analysis: (1) How are responsibilities for identification, development, overseas education, return, and information management distributed among the principal actors? (2) Which connections between these functions are explicitly regulated, and where do formal overlaps or omissions remain? (3) Which corrective measures can be implemented through administrative clarification, and which require broader inter-agency or presidential-level reform?

2. Literature Review and Analytical Framework

The institutional approach provides the first foundation for the analysis. North (1990) defines institutions as the formal and informal rules that structure interaction. This distinction is essential in regulatory research because a formal rule does not necessarily describe actual organizational practice. Scott's (2014) three-pillar framework further distinguishes regulative, normative, and cultural-cognitive dimensions. The present study focuses primarily on the regulative pillar: legally stated authority, procedures, reporting relationships, and obligations. The findings should therefore be read as an assessment of formal design rather than a complete assessment of institutional performance.

The second foundation is the literature on horizontal coordination. Peters (1998) argues that coordination across organizations is among the most persistent challenges of public administration because agencies protect their mandates, resources, and policy identities. Hood's (1991) analysis of New Public Management helps explain why specialization may increase organizational focus while simultaneously weakening cross-organizational continuity. A policy field can become more technically capable but more fragmented if each specialized body optimizes its own outputs without responsibility for the complete trajectory of the target population.

Whole-of-government and joined-up-government approaches emerged as responses to this fragmentation. Christensen and Laegreid (2007) emphasize shared objectives, information, and accountability, while Pollitt (2003) warns that structural reorganization alone rarely produces integrated processes. Bouckaert, Peters, and Verhoest (2010) distinguish hierarchical, market, and network

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coordination mechanisms and show that public systems normally combine them. For the gifted-youth field, hierarchy is visible in presidential and cabinet acts, while network coordination is required for data exchange, candidate handovers, and shared monitoring across organizational boundaries.

Strategic talent-management theory adds a third perspective. Collings and Mellahi (2009) argue that strategically important talent pools require differentiated institutional arrangements rather than ordinary human-resource procedures. At national level, Khilji, Tarique, and Schuler (2015) propose a macro perspective in which education, labor markets, migration, and public policy jointly shape a talent ecosystem. This perspective is directly relevant to gifted youth: the value of early identification is not realized at the moment of selection but through continuity from education to advanced training and productive employment.

On the basis of this literature, the article defines an institutional connection as a formal rule that links at least two actors, stages, datasets, or accountability processes. A governance risk is identified when one of three conditions is present: (a) a required function is not assigned to any actor; (b) two or more actors have materially similar mandates but no priority, referral, or information-sharing rule is specified; or (c) actors report outputs independently but no shared outcome framework connects their activities. This definition deliberately avoids treating every organizational overlap as a failure. Overlap may provide redundancy or wider access; it becomes a governance risk only when the rules for managing it are absent or unclear.

3. Methodology

3.1 Research Design

The study uses structured qualitative document analysis. Documentary analysis is appropriate when the research question concerns formally assigned authority, institutional status, procedural requirements, and legally defined relationships (Bowen, 2009). Content analysis strengthens this design by requiring explicit units of analysis, predefined analytical questions, and traceable links between conclusions and source provisions (Krippendorff, 2018; Mayring, 2014).

The analysis was designed as a legal-institutional mapping exercise rather than a quantitative content study. The original manuscript reported 148 coded rules, 41 linkage rules, and a 91.4% intra-coder agreement rate, but no clause-level dataset or recoding file was supplied. Those numerical claims have therefore been removed. The revised study reports only results that can be traced to identified legal provisions and provides a clause-level evidence map in Appendix A. No inter-coder or intra-coder reliability coefficient is claimed.

The temporal cutoff is 1 January 2026. Consolidated versions of legal instruments effective on that date were used. Amending instruments were not counted as separate empirical documents when their changes were already incorporated into a consolidated act. For example, PF-197 is treated as contextual evidence for amendments affecting public-administration internships and the El-yurt umidi relationship, not as a second independent source for provisions already incorporated into the relevant consolidated text. This rule prevents double-counting.

3.2 Corpus Selection and Version Control

A document was included when it met all of the following criteria: it was a national-level legal act; it established or materially regulated an institution or programme connected to gifted youth; it contained provisions relevant to at least one of the five functional stages; and it was in force on the cutoff date. Purely technical staffing or financial amendments were excluded unless they changed an institutional mandate. The resulting core corpus contains seven instruments. Later amendments and contextual acts were used only to interpret the consolidated texts and were not counted as additional core documents.

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Table 1. Legal corpus and analytical treatment

Instrument	Institutional purpose	Relevant functions	Analytical status
PF-86 (15 May 2025)	President's Gifted Children initiative and National Programme	Identification; school advisers; platform; 200 annual overseas-education quotas from 2027	Core
PF-77 (5 May 2025)	Reorganization and scholarship rules of the El-yurt umidi Foundation	Overseas education; competitions and non-competitive routes; return and service obligations; scholarship-holder data	Core
PF-61 (26 March 2025)	Youth-policy measures, including the Yorqin iste'dod project	Social targeting and the policy origin of the later National Programme	Core
PF-106 (14 April 2022)	Expansion of the specialized-school network	Institutional development of specialized education	Core
CMR No. 526 (25 June 2019)	Regulation on Presidential Schools	School status, admission, curriculum, and graduation arrangements	Core
CMR No. 233 (5 May 2022)	Regulation on specialized boarding schools and specialized schools	Admission, educational stages, class size, progression, and removal rules	Core
CMR No. 550 (11 September 2020)	Regulation on the Agency for Youth Affairs	General youth-policy coordination, international participation, and the Youth Register	Core
PF-197 (29 October 2025)	Public-administration reform and internship coordination	Context for the adjacent role of the Management Efficiency Agency	Contextual; not separately counted

Note. CMR = Cabinet of Ministers Resolution; PF = Presidential Decree. Consolidated versions effective on 1 January 2026 were used. Amendments incorporated into consolidated texts were not double-counted.

3.3 Analytical Procedure

The unit of analysis was a provision or a semantically independent part of a provision. Each relevant provision was entered into an evidence matrix and examined through seven categories. The categories were used as analytical questions rather than as a basis for numerical frequency claims.

Table 2. Analytical framework

Category	Operational question
Institutional status	Which body is established, subordinated, or authorized?
Target population and coverage	Which age, educational stage, or candidate group is covered?
Function	Does the provision concern identification, development, overseas education, return, or information?
Decision authority	Who selects, approves, finances, monitors, or reports?
Connection rule	Is referral, data exchange, priority, or joint decision-making specified?
Continuity	Does the provision preserve support or records when a participant changes stage or institution?
Accountability	Is the result measured only at departmental level or through a shared outcome?

The analysis proceeded in four steps. First, actors and their legal mandates were mapped. Second, provisions were reorganized by function to reveal how the same stage was regulated across institutions. Third, potential gaps were identified using the operational definition stated above. Fourth, each proposed finding was checked against the legal text and classified according to evidence strength, system reach, and level of remedy. Numerical parameters in the acts were used only where the denominator and institutional meaning were clear. The study therefore distinguishes a statutory quantity from an observed outcome.

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3.4 Trustworthiness and Limitations

Trustworthiness is supported through source restriction, version control, clause-level traceability, and negative-case reasoning. Where the evidence did not justify a conclusion, the claim was narrowed. For example, the existence of several information systems does not prove that data are never exchanged in practice; it establishes only that a comprehensive exchange protocol was not identified in the selected legal corpus. Similarly, overlapping eligibility does not prove double financing; it establishes the need for a published priority and deduplication rule.

The study has four limitations. First, it is a de jure analysis and cannot establish actual organizational practice. Second, the legal landscape is dynamic; findings are tied to the 1 January 2026 cutoff. Third, foreign cases are illustrative rather than a systematic comparative dataset. Fourth, the document analysis was conducted by a single author, so interpretive decisions remain open to independent replication. These limitations are addressed by providing explicit source mappings and by framing the results as governance risks and empirically testable propositions.

4. Results

4.1 Institutional Field

The formal field is better described as four principal actors, one inter-agency coordinating layer, and one adjacent public-administration actor rather than as five equivalent institutions. The Research and Practical Centre operates within the Agency and should not be counted as an independent actor. Likewise, the Management Efficiency Agency has a specific role in public-service internship coordination but does not govern the entire gifted-youth system.

Table 3. Institutional actors and structures

Actor or structure	Coverage	Relevant mandate	Status in the field
Agency for Specialized Educational Institutions	Grades 5-11 and National Programme participants	Specialized schools, admission, school advisers, supplementary preparation, school-level information	Principal actor
Research and Practical Centre under the Agency	Applicants and pupils within the Agency system	Assessment, methodological support, and international assessment cooperation	Internal specialized structure
El-yurt umidi Foundation	Applicants to foreign study and internships; scholarship holders	Scholarship selection, financing, database maintenance, return and service obligations	Principal actor
Agency for Youth Affairs	Young people generally	Unified youth-policy coordination, international competitions and broad overseas-education support mandate; Youth Register	Principal actor with broad mandate
National Council and Republican Commission under PF-86	President's Gifted Children initiative	Strategic direction, inter-agency coordination, and quota-related decisions	Coordinating layer
Management Efficiency Agency	Public servants and public-sector talent	Demand formation and coordination for public-service internships; career-development interface	Adjacent actor

4.2 Functional Governance Mechanisms

Identification. The system contains several legitimate identification mechanisms serving different purposes. Specialized schools use entrance examinations for school admission. PF-86 authorizes the annual selection of up to 1,500 Grade 9 graduates for the National Programme. The El-yurt umidi Foundation applies scholarship eligibility and selection procedures to candidates already seeking foreign study or internships. These are not identical processes, but they create multiple candidate records that may later refer to the same person.

Development. Development functions are concentrated at school level. Presidential and specialized schools provide differentiated curricula, international programmes, advanced subject instruction, and supplementary courses. Under PF-86, National Programme participants are assigned to school advisers and

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receive additional preparation through a dedicated platform during Grades 10 and 11. The statutory maximum ratio of participants to a school adviser is 1:15. PF-86 separately establishes a group of 14 chief advisers to coordinate the activity of school advisers across the regions. The chief advisers and school advisers perform different functions, so the number 14 cannot be used as the denominator for calculating direct participant caseload.

Overseas education. PF-77 and PF-86 establish several routes with different eligibility conditions. PF-77 provides open scholarship competition routes for candidates admitted to eligible top-ranked institutions. It also provides non-competitive routes for candidates with full tuition grants at top-300 institutions and for graduates of Presidential, creative, and specialized schools admitted to top-20 bachelor's programmes with at least 50% tuition support. PF-86 provides 200 annual quotas from 2027 for graduates of the Al-Beruniy school and National Programme participants admitted to top-100 institutions with at least 50% tuition support. These instruments can serve complementary groups, but some candidates may satisfy more than one route.

Return and professional utilization. The most developed formal return mechanism is attached to El-yurt umidi support. PF-77 establishes continuous service periods of two years after a targeted internship, five years after a bachelor's degree, three years after a master's degree, and five years after doctoral study, together with contractual and reimbursement consequences. Comparable follow-up obligations are not uniformly stated for all participants of the wider President's Gifted Children community. This difference does not necessarily indicate a defect, because the programmes have different purposes, but it limits system-wide tracking of long-term outcomes.

Information management. The legal framework refers to several information resources, including the El-yurt umidi scholarship-holder database, the Youth Register, the dedicated National Programme platform, and the initiative's community platform. The acts establish these resources for distinct purposes. The selected corpus does not specify a complete participant-level data architecture connecting school identification, programme participation, scholarship support, return, and employment. The formal issue is therefore not the existence of databases but the absence of a clearly documented end-to-end exchange and governance protocol.

Table 4. Principal formal routes for overseas-education support

Route	Principal eligibility	Procedure	Responsible mechanism
PF-77: full tuition grant route	Admission to an eligible top-300 institution with full tuition covered	Non-competitive scholarship support for transport and living costs, subject to the Foundation's rules	El-yurt umidi Foundation
PF-77: specialized-school graduate route	Graduate of a Presidential, creative, or specialized school; top-20 bachelor's admission; at least 50% tuition grant	Non-competitive scholarship route	El-yurt umidi Foundation
PF-77: open competition	Admission to an eligible top-300 institution and compliance with competition requirements	Testing/interview and selection within approved quotas	El-yurt umidi Foundation
PF-86: National Programme quota	Al-Beruniy school graduate or National Programme participant; top-100 admission; at least 50% tuition grant	Up to 200 annual quotas from 2027; selection applies when eligible candidates exceed 200	Ministry of Economy and Finance and El-yurt umidi Foundation under PF-86

Note. The Agency for Youth Affairs has a broad coordination mandate but is not classified here as a separate scholarship-financing route because the reviewed regulation does not define a comparable operational scholarship mechanism.

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4.3 Governance Risks in the Formal Design

Table 5. Governance risks identified at the level of formal design

Governance risk	Documentary basis	Careful interpretation
R1. Overlapping eligibility routes	A candidate may satisfy both PF-77 and PF-86 conditions. The selected corpus does not state a single cross-instrument priority or deduplication rule.	Potential inconsistent treatment or duplicate administrative processing; actual double financing is not established.
R2. Fragmented information architecture	Four information resources are established for different functions, but an end-to-end participant identifier and exchange protocol are not specified in the core acts.	System-level trajectories and outcomes may be difficult to reconstruct; actual data exchange must be tested empirically.
R3. Uneven transition responsibility	PF-86 provides advisers and preparation for National Programme participants, while comparable application support is not clearly assigned for all gifted pupils outside that programme.	Access to structured transition support may vary by programme membership; actual support coverage is unknown.
R4. Weak continuity after school exit	The specialized-school regulation provides grounds for removal, but the reviewed corpus does not establish a system-wide soft-exit and follow-up pathway.	Previously identified talent and support history may not remain visible across institutions; actual school practice is unknown.
R5. Fragmented system-level accountability	Actors have separate mandates and reporting relationships, while no shared outcome framework links identification to later education, return, and employment.	Departmental output optimization may not reveal whole-trajectory performance.

4.4 Correct Interpretation of the Quantitative Parameters

The legal acts contain several quantitative parameters, but they must be interpreted according to their institutional meaning. PF-86 authorizes the annual selection of up to 1,500 Grade 9 graduates for the National Programme and, from 2027, 200 annual overseas-education quotas for eligible graduates and participants. The calculation 200/1,500 = 13.3% is arithmetically correct. It is only a nominal quota-to-maximum-entry ratio, however, because the numerator and denominator refer to different stages and eligibility conditions. It is not an observed transition rate, and it does not demonstrate that 86.7% of participants receive no subsequent support.

The adviser provisions require an equally important distinction. The 1:15 maximum applies to school advisers who work directly with National Programme participants. The 14 chief advisers coordinate adviser activity at regional level. Dividing 1,500 participants by 14 chief advisers produces a mathematically correct but institutionally invalid ratio. A valid workload indicator requires administrative data on the actual number of school advisers and the number of participants assigned to each adviser.

The revised analysis therefore uses statutory quantities as design parameters, not as empirical performance measures. Where an outcome cannot be calculated from available integrated data, the baseline is reported as 'not currently measurable' rather than zero.

Table 6. Correct interpretation of selected statutory parameters

Parameter	Statutory value	Valid interpretation
Maximum annual National Programme intake	Up to 1,500 Grade 9 graduates	Scale parameter for entry into the programme; not the number seeking foreign study
Annual PF-86 foreign-study quota from 2027	200 eligible participants/graduates	Nominally 13.3% of the maximum annual intake, but not an observed transition rate
School adviser ratio	No more than 15 participants per school adviser	Direct participant-support standard; actual compliance requires adviser assignment data
Chief adviser group	14 positions	Regional coordination of school advisers; not a direct caseload denominator
El-yurt umidi service periods	2, 5, 3, and 5 years by programme type	Formal return and utilization mechanism for Foundation-supported participants

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5. Discussion

The findings show a system with substantial institutional capacity but incomplete integration. The principal strengths are clear: specialized educational institutions operate under dedicated rules; the National Programme introduces structured identification and school-level support; the El-yurt umidi Foundation has differentiated scholarship routes and enforceable return obligations; and several information platforms already exist. The challenge is therefore not institutional absence. It is the design of the interfaces between strong but separately regulated components.

This pattern is consistent with the coordination literature. Specialization can improve expertise and operational focus while producing gaps at organizational boundaries (Hood, 1991; Peters, 1998). The whole-of-government perspective suggests that integration depends less on creating another organization than on shared objectives, data, and accountability (Christensen & Laegreid, 2007). In the present case, adding a new coordinating body without clarifying referral, priority, and information rules could increase formal complexity rather than reduce it.

The overlap between PF-77 and PF-86 should not be described simply as duplication. The routes serve partially different policy goals and candidate groups. Redundancy can increase access and resilience. The governance requirement is a transparent rule for candidates who satisfy more than one route: which instrument has priority, which expenses may be financed under each route, how the participant is recorded, and how duplicate public financing is prevented. The appropriate target is therefore not zero overlapping eligibility but 100% of overlapping cases resolved under a published rule and 0% duplicate financing.

The information issue is similarly nuanced. The existence of separate systems is not inherently inefficient. Specialized databases may be necessary for operational security and purpose limitation. Integration should not mean unrestricted centralization of personal data. A more appropriate model is a federated information architecture using a single participant identifier, defined data fields, role-based access, lawful exchange, and an auditable record of transfers. Such a model would preserve institutional ownership while enabling trajectory reconstruction and system-level analysis.

The transition-support issue requires empirical caution. PF-86 clearly establishes adviser support for National Programme participants. The formal gap concerns gifted pupils outside that programme, not an absolute absence of application support. Schools, families, private providers, or local programmes may already provide assistance. A subsequent study should therefore measure who receives portfolio development, examination preparation, application counselling, recommendation support, and financial guidance, and whether access differs by region, school type, gender, socioeconomic status, or programme membership.

The soft-exit proposal responds to a continuity problem rather than questioning academic standards. Specialized schools require mechanisms to maintain programme quality, and removal provisions may be legitimate. The issue is whether leaving a specialized institution should erase the participant's prior identification and support history. A soft-exit protocol could retain the record, document the reason for departure, provide referral to an alternative programme, and establish a limited follow-up period. This would protect both institutional standards and the state's earlier investment in identifying talent.

Finally, accountability should move from institutional outputs to trajectory outcomes. Current actors can report admissions, scholarships, competitions, school results, returns, or employment within their own mandates. A system-level framework would not replace those indicators. It would add a small shared set: continuity of records, equitable access to transition support, resolution of overlapping eligibility, completion of overseas study, return, sector-relevant employment, and long-term contribution. These outcomes can only be measured after information governance is clarified.

5.1 Illustrative International Comparison

The international comparison is deliberately limited to three illustrative cases and uses only claims supported by official sources. It is not a matched comparative study and does not rank national systems.

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Its purpose is to identify design options that may inform domestic reform. The source base comprises the Singapore Ministry of Education's programme overview (2026), the Republic of Korea's Gifted Education Promotion Act and Enforcement Decree (2000/2023), the Daryn Centre's institutional description (n.d.), and the official Bolashak programme update (Center for International Programs, 2025).

Table 7. Illustrative international design features

Case	Documented design feature	Relevance and limitation
Singapore	The Ministry of Education uses a centrally administered two-stage identification process and an enriched programme for intellectually gifted pupils. The current GEP is being replaced from 2027, demonstrating that even centralized models evolve.	Central standards can coexist with periodic redesign; the Singapore model does not address the full overseas-study and return trajectory.
South Korea	The Gifted Education Promotion Act establishes a central committee, regional committees, formal selection structures, gifted institutions, research institutes, student records, and an integrated database framework.	Statutory coordination and integrated records provide a useful model for connecting multiple institutions while preserving regional implementation.
Kazakhstan	The Daryn Centre describes a unified national system for identifying and supporting gifted children, while the Bolashak mechanism operates as a separate overseas-scholarship institution.	School-level coordination and overseas scholarship may remain institutionally separate; their interface must be examined rather than assumed.

6. Proposed Governance Model

The proposed model has three stages. Stage I clarifies rules that can be corrected without building a new information system. Stage II creates the legal and technical basis for governed data exchange. Stage III introduces outcome-based management after reliable linked data become available. The stages are sequential because digitizing ambiguous rules would reproduce ambiguity electronically.

Table 8. Staged implementation roadmap

Stage	Measures	Responsible actors	Expected result
Stage I: regulatory clarification (0-12 months)	Publish a cross-instrument priority and financing rule; define transition-support responsibility; introduce a soft-exit and referral procedure	National Council, El-yurt umidi Foundation, Agency for Specialized Educational Institutions, relevant ministries	Clear treatment of overlapping cases and continuity at institutional boundaries
Stage II: governed information exchange (6-24 months)	Adopt a single participant identifier, minimum shared dataset, data-quality standards, lawful exchange protocol, and role-based access	Agency for Youth Affairs, Agency for Specialized Educational Institutions, El-yurt umidi Foundation, digital-government bodies	Reconstructible trajectories without unnecessary centralization of all operational data
Stage III: shared outcome management (18-36 months)	Overlay a concise system-level dashboard on existing departmental reporting and commission annual independent review	National Council and designated analytical operator	Assessment of continuity, equity, return, employment, and long-term yield

6.1 Monitoring Indicators

Baselines should be populated only when the necessary administrative data exist. A missing integrated record is reported as 'not currently measurable,' not as 0%. Targets below are proposed management targets and should be validated during implementation planning.

Table 9. Proposed monitoring indicators

Indicator	Formula	Baseline status	Proposed target
1. Record linkage rate	Participants with successfully linked records across relevant systems / participants requiring linkage x 100	Not currently measurable	>=95% after Stage II
2. Trajectory continuity	Participants with no unexplained break in the recorded pathway / total tracked participants x 100	Not currently measurable	>=90%

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Indicator	Formula	Baseline status	Proposed target
3. Overlap resolution	Candidates eligible under two or more routes resolved under the published priority rule / all overlapping cases x 100	Not recorded	100%
4. Duplicate public financing	Overlapping cases receiving duplicate financing for the same eligible expense / funded overlapping cases x 100	Not measured	0%
5. Transition-support coverage	Graduates receiving documented application support / eligible graduates x 100	Measurable only for defined programmes	>=80% system-wide
6. School-adviser caseload	Assigned participants / active school advisers	Requires assignment data	<=15 participants per adviser
7. Soft-exit continuity	Departing pupils with a documented referral and follow-up plan / all relevant departures x 100	Not currently specified	>=95%
8. Return and sector employment	Supported graduates employed in an agreed relevant sector within 12 months / supported graduates completing study x 100	Partly measurable within El-yurt umidi	Target to be set after baseline
9. Long-term system yield	Participants in highly qualified employment at cohort year N+10 / identified cohort x 100	Not currently measurable	First valid result at N+10 for the first fully linked cohort

7. Empirical Verification Agenda

The legal analysis generates propositions that should be tested with administrative and field data. The first priority is a record-linkage pilot using a small, lawfully authorized sample from the Agency, the Youth Register, and the El-yurt umidi Foundation. The pilot should measure match rates, missing identifiers, duplicate records, and the proportion of participants whose pathway can be reconstructed without manual case collection.

The second priority is a transition-support study covering graduates of Presidential schools, specialized schools, National Programme participants, and comparable gifted pupils outside the National Programme. A standardized survey and administrative audit should measure examination preparation, portfolio development, university application support, recommendation letters, scholarship guidance, and associated household expenditure.

The third priority is process tracing of overlapping overseas-education cases. Rather than assuming conflict, researchers should identify candidates who met two or more routes, document how each case was resolved, and test whether decisions were consistent. The fourth priority is a cohort study of pupils leaving specialized institutions, including reasons for departure, referral, subsequent school placement, educational outcomes, and continued participation in talent-development programmes.

Finally, system-level accountability should be tested through a reporting-form audit. Departmental indicators should be mapped against the proposed shared outcomes to identify which measures already exist, which can be calculated through linkage, and which require new data collection.

8. Conclusion and Recommendations

Uzbekistan has created a substantial institutional foundation for developing gifted youth. The formal framework supports specialized schooling, national identification, individualized preparation, several overseas-education routes, scholarship administration, and return obligations. The revised analysis does not portray the system as institutionally weak. It identifies the need to connect strong components through clearer interface rules.

Five governance risks are supported at the level of formal design: overlapping eligibility routes without a single cross-instrument priority rule; fragmented information architecture; unevenly specified responsibility for the transition to foreign university; limited continuity provisions when pupils leave specialized institutions; and fragmented system-level accountability. These findings do not demonstrate implementation failure. They identify issues that should be clarified and empirically tested.

The headline quantitative provisions must be interpreted carefully. The 200 annual quotas from 2027 equal 13.3% of the maximum annual intake of 1,500 only as a nominal comparison between different

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stages. The 1:15 ratio applies to school advisers, whereas the 14 chief advisers coordinate adviser activity; no 107:1 direct caseload or 7.1-fold overload can be inferred from those provisions.

The following measures are recommended:

- Adopt a published priority, cost-allocation, and deduplication rule for candidates who qualify under more than one overseas-education route.
- Assign explicit responsibility for the school-to-university transition and define the minimum package of application support available across eligible programmes.
- Introduce a soft-exit protocol that preserves records, documents reasons for departure, and provides referral to an alternative developmental pathway.
- Develop a federated information architecture based on a single participant identifier, a minimum shared dataset, lawful exchange, role-based access, and audit logs.
- Create a concise system-level dashboard that complements departmental indicators and measures continuity, equitable access, completion, return, employment, and long-term contribution.
- Publish clause-level evidence and administrative indicator definitions so that future evaluations are reproducible and independent of the original analyst.

Implementation should proceed in stages. Regulatory clarification can begin immediately, while data integration and long-term outcome measurement require legal, technical, and privacy safeguards. The principal contribution of this article is therefore a corrected and reproducible framework for moving from a collection of institutional mandates toward an integrated system of strategic talent development.

Ethics and Data Availability Statement

The study used publicly accessible legal and institutional documents and did not involve human participants or personal data. The clause-level evidence map used in the analysis is reproduced in Appendix A. Future research using administrative records must obtain the necessary institutional authorization and comply with applicable data-protection requirements.

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Appendix A. Clause-Level Evidence Map

The appendix lists the principal provisions supporting the central findings. It is intended to make the analytical chain transparent and to replace unsupported aggregate coding counts.

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Table A1. Evidence supporting the principal findings

Provision or source	Documented content	Analytical use
PF-86, para. 6(a)	Up to 1,500 Grade 9 graduates selected annually	Maximum programme-entry parameter; not an overseas-study denominator
PF-86, para. 6(b)	Participants assigned to school advisers; maximum ratio 1:15	Direct support standard applies to school advisers
PF-86, paras. 9-10	Group of 14 chief advisers coordinates school advisers across regions	Chief advisers are not the direct participant-caseload denominator
PF-86, para. 8	200 annual quotas from 2027 for eligible top-100 admissions with at least 50% tuition grant	Separate later-stage quota; 13.3% is only a nominal comparison with 1,500
PF-77, relevant scholarship provisions	Top-300 full-grant route, top-20 specialized-school graduate route, and open competition route	Creates multiple routes with partially overlapping eligibility
PF-77, service-obligation provisions	Service periods differentiated by internship and degree level	Strong formal return and utilization mechanism within the Foundation
CMR No. 233, admission and progression provisions	Specialized-school stages, class size, progression and removal grounds	School quality control is formalized; system-wide soft-exit referral is not identified
CMR No. 550, Agency for Youth Affairs regulation	Broad coordination mandate and Youth Register information system	Relevant coordination and data asset; not evidence of a separate scholarship-financing route
PF-77, PF-86, and CMR No. 550 considered together	Several databases/platforms are established for different purposes	An end-to-end participant identifier and exchange protocol are not specified in the core corpus
All core instruments considered together	Departmental mandates and outputs are specified	No shared whole-trajectory outcome framework was identified in the selected corpus

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THE ROLE OF ANTHROPOCENTRIC FACTORS IN KARAKALPAK ANTHROPONYMS

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ABSTRACT

This article examines the anthropocentric factors that shape the formation, semantics, and cultural functions of Karakalpak personal names. Drawing on descriptive, historical-comparative, lexical-semantic, structural-morphological, component, etymological, and linguocultural methods, the study analyzes anthroponymic material documented in Karakalpak onomastic scholarship and explanatory sources. The findings show that naming practices encode parental intentions, protective beliefs, religious values, family circumstances, birth events, physical characteristics, gender expectations, social status, historical memory, territorial and clan affiliation, and emotional evaluation. Wish-bearing names express hopes for health, prosperity, intelligence, courage, or social success, whereas protective names symbolically guard children against illness, loss, and harmful forces. Religious anthroponyms frame the child as a divine gift and connect naming with moral ideals. Gendered names reproduce culturally valued images of femininity and masculinity, while status components such as bek, bay, mırza, tóre, and sultan project authority, wealth, and prestige. Names associated with heroes, poets, places, clans, and significant events preserve collective memory and social identity. The study concludes that Karakalpak anthroponyms function not merely as nominative labels but as culturally embedded, human-centered codes through which personal experience, social expectations, belief systems, and ethnocultural continuity are linguistically transmitted across generations and thereby connect individual identity with the cultural history of society.

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Keywords:
linguoculturology, onomastics, anthroponymy, semantics, Karakalpak anthroponyms, anthropocentric paradigm, anthropocentric factors.



INTRODUCTION

The study of Karakalpak personal names from an anthropocentric perspective requires each name to be interpreted not merely as a nominative unit but as a culturally meaningful phenomenon that reflects an individual's worldview, beliefs, values, psychological state, and social experience. The scholarly literature emphasizes that anthroponymy encompasses all proper names referring to people and should be studied in close connection with language, history, ethnography, sociology, and law (Sayımbetov, 2000, p. 72). In addition, the modern anthropocentric approach places the relationship among person, language, and worldview at the center of analysis and requires researchers to consider the name-giver's spiritual and creative intentions, ethnocultural experience, and mental stereotypes in the naming process (Vasil’eva & Dmitrieva, 2021, pp. 478–488). From this perspective, Karakalpak names function as linguistic units that embody the people's experiences, aspirations, beliefs, social relations, and cultural memory.

MATERIALS AND METHODS

The analysis drew on the works of Sayımbetov (2000), Vasil'eva and Dmitrieva (2021), Abdinazimov and Daniyarova (2016), Aitbaeva (2024), and Jarimbetova (2023) to examine the anthropocentric factors and semantic-structural features involved in the formation and development of Karakalpak personal names.

The study employed descriptive, historical-comparative, lexical-semantic, structural-morphological, component, etymological, and linguocultural methods to investigate the topic and analyze the selected materials and examples.

RESULTS

Parental intention is a primary anthropocentric factor in Karakalpak naming. An examination of the meanings of Karakalpak names shows that the emotional and social responses associated with a child's birth are often encoded in the semantics of the name. Explanatory dictionaries interpret many names through wishes such as "we have achieved our goal," "may his wish come true," "may he be a companion to his parents," "may he become intelligent and knowledgeable," and "may he serve the people." These interpretations demonstrate that choosing a name is not accidental but constitutes a conscious nominative act through which parents project a spiritual orientation, social role, and desired future identity onto the child. Thus, in Karakalpak anthroponymy, a name can function as the linguistic expression of parental aspiration and as a semantic direction assigned to the child's future development (Abdinazimov & Daniyarova, 2016; Sayımbetov, 2000).

Names associated with parental intentions form a distinct semantic layer expressing wishes, aspirations, intentions, and dreams. Names such as Murat, Muratbay, Muratbek, Allamurat, and Aymurat convey the motifs of attaining a goal, fulfilling a dream, and realizing an intention. Names such as Allaniyaz, Allanazar, Ábdimurat, and Ábdiniyaz emphasize that the child was prayed for or requested from God. Such names encode the parents' spiritual needs, their joy at the birth of a long-awaited child, and their faith in divine grace. Consequently, wishes expressed through Karakalpak names constitute not only an emotional phenomenon but also an anthropocentric factor with religious, spiritual, and social dimensions (Abdinazimov & Daniyarova, 2016; Sayımbetov, 2000).

The protective motif constitutes a particularly prominent anthropocentric layer in Karakalpak names. Since ancient times, protective names have been given to shield children from the evil eye, malevolent spirits, and other perceived threats. Unusual names were also selected for this purpose within systems of superstition and ritual belief. Later lexical sources make this motif especially clear. Names such as Aman, Amanbay, Amanbek, Amanbiyke, Amanlyk, Amantay, Amanjan, Amankul, Amantur, and Amangul are explained through wishes such as "may he live a long life," "may he avoid hardship," "may he bring prosperity to the family," and "because the previous child died, may this child survive." In these cases, the name is directly associated with the child's survival, symbolic protection, and the family's hope that the child will live (Abdinazimov & Daniyarova, 2016; Sayımbetov, 2000).

Another expression of the protective motif appears in names associated with death, loss, dangerous circumstances, and a symbolic strategy of "deception." For example, some explanations of the name Almagul convey the meaning "do not take my daughter; do not touch her; let her live rather than die." This interpretation demonstrates the name's direct apotropaic, or protective, semantic function. Similarly, the use of Aman and related names in families that had previously lost children expresses the hope that the newborn will survive, bring peace to the family, and make future family life safe. In such cases, the name functions as a symbolic linguistic defense against real-life threats (Abdinazimov & Daniyarova, 2016; Sayımbetov, 2000).

Religion is one of the most important sources of anthropocentric meaning in Karakalpak personal names. In names such as Allabergen, Allaberdi, Allamjar, Allamurat, Allanazar, Allaniyaz, Allashúkir, Allayar, Allayarkeldi, Qudaybergen, Qudayderdi, Qudayar, Qudyar, Qudaynazar, Qudayshúkir,

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Táńirbergen, Táńirberdi, Reyimbergen, Rehimnazar, and Iyembergen, the child is interpreted as a divine gift or a manifestation of divine favor. The anthropocentric essence of religious naming lies in the parents' encoding of their deepest spiritual needs in the name: the desire to have a child, protect the child, guide the child along a righteous path, and entrust the child to divine protection. Thus, faith and human need are inseparably connected in the religious layer of Karakalpak names (Abdinazimov & Daniyarova, 2016; Sayımbetov, 2000).

Religious motives also appear through associations with revered religious figures and members of the Prophet Muhammad's family. Names such as Aysha, Ayshabiybi, Ayshabiyke, Ayshagúl, and Ayshaxan are interpreted as expressing the wish that a girl attain high status, in association with figures revered in Islamic tradition. The name Aknazar similarly conveys the wish that God's favorable gaze rest upon the child. These examples show that the religious anthroponymic motif functions not only as a prayer but also as the selection of a moral and social ideal. Through such a name, parents wish the child well-being and sustenance while associating the child with a sacred exemplar (Abdinazimov & Daniyarova, 2016; Sayımbetov, 2000).

Anthropocentric motifs related to family circumstances and life events are clearly reflected in Karakalpak names. Explanations of the name Amangeldi refer to several situations, including the safe birth of a child, a birth occurring on the day the father returned from a journey, a wish for a father or brother to return safely from military service, or a birth following the mother's safe arrival at a destination. The name Amanjol may express a mother's wish to give birth safely while travelling or a hope that the child's journey through life will be safe. Names such as Aymereke, Aytbay, Aytgul, Nawrız, Kurban, Ramazan, Sapar, and Tanjarbay connect a birth with a festival, month, season, religious observance, night, moonlight, journey, or other specific event. These names show that an individual's birth can be recorded linguistically as part of the family's biography (Abdinazimov & Daniyarova, 2016; Sayımbetov, 2000).

Names given to children born after a difficult or prolonged period of waiting also possess distinctive anthropocentric value. Some explanations of the name Miyasar include meanings such as "we were blessed with the happiness of having a daughter" and "Allah blessed us with this girl." In this context, the name expresses the parents' spiritual experience, gratitude, and recognition of the child as a precious gift. Names such as Aykumar and Aytileu likewise carry connotations of longing, need, and prolonged waiting for a child. Thus, Karakalpak names often conceptualize the birth of a child as an emotional and spiritual event rather than merely a biographical occurrence (Abdinazimov & Daniyarova, 2016; Sayımbetov, 2000).

Names based on physical traits and circumstances of birth also constitute an important anthropocentric category in Karakalpak anthroponymy. In one explanation of the name Abbaz, the child is described as being "born with a splinter." Ayzada may refer to a moon-shaped mark on the forehead; Anar, Anara, Anarbiybi, Anargul, and Anarkhan may denote a red birthmark or a ruddy complexion; Altybayan may refer to an extra finger; Oraqbay may refer to the umbilical cord being cut with a particular implement; and Oralbay may describe a child born with the umbilical cord wrapped around the body. These examples show that a distinctive physical feature, birthmark, or circumstance observed at birth can directly motivate the selection of a name. This category therefore represents an empirical, observation-based layer of anthropocentric naming (Abdinazimov & Daniyarova, 2016; Sayımbetov, 2000).

Gender is clearly expressed in Karakalpak personal names. In names given to girls, qualities such as beauty, tenderness, refinement, purity, radiance, sweetness, and intelligence commonly function as cultural ideals. Names such as Ajarbiyke, Ajargúl, Aygózzal, Ayjamal, Ayperi, Aysuluw, Ayman, Aqmaral, Aqılay, Aqlıyma, Aysholpan, Aqsholpan, Ayshınar, and Móldir express wishes that a girl will be beautiful, graceful, pure, intelligent, radiant, and valued. This naming system constructs the image of a girl as a model of aesthetic and moral excellence. Thus, in Karakalpak anthroponymy, gender is not merely a grammatical or formal distinction but a cultural ideal encoded in the name (Abdinazimov & Daniyarova, 2016; Sayımbetov, 2000).

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In boys' names, meanings associated with strength, bravery, respect, rank, leadership, and social status predominate. Names such as Azamat, Aybat, Agabek, Aytöre, Aymırza, Aypolat, Aqpolat, Aydos, Aydosbay, Aydosbiy, Mamanbiy, and Alpamıs convey courage, bravery, honor, public service, and the ability to lead. Through these names, parents imagine the child as a future social actor, leader, source of support, or person who serves the community. Male names therefore reflect a gendered ideal characterized by social agency and strength (Abdinazimov & Daniyarova, 2016; Sayımbetov, 2000).

A distinctive and complex expression of gendered expectations appears in girls' names that convey a desire for the next child to be a boy. Names such as Ulbosın, Ulmeken, Uljan, Ulboğan, Ulzada, Uldana, Ultuw, Dámexan, Dametken, and Dámeli express the intention that "the child born after this girl will be a boy." Some sources also associate this practice with the belief that such names could deceive demons or mislead malevolent forces. These names mark the intersection of gender expectations, family strategies, and ancient beliefs in Karakalpak society. From an anthropocentric perspective, they directly reflect the family's demographic, social, and spiritual concerns (Abdinazimov & Daniyarova, 2016; Sayımbetov, 2000).

Social and status-related motives also play an important role in Karakalpak personal names. Components such as bek, bay, mırza, tóre, and sultan function not merely as structural elements but also as semantic markers of social standing, authority, leadership, respect, and wealth. Agabek conveys brotherhood and respect; Sawlat denotes rank; Aytkhu suggests nobility; Elmırza evokes leadership of the people; Aqdáwlet and Aydáwlet suggest statehood or prosperity; and Aqshagúl evokes wealth and sustenance. Through such names, parents express the hope that the child will attain a respected social position and achieve material and spiritual well-being. Social ideals are therefore an active source of nomination in Karakalpak anthroponymy (Abdinazimov & Daniyarova, 2016; Sayımbetov, 2000).

The motif of emulating a historical figure, hero, or idealized image is also prominent in Karakalpak names. Names such as Abbas, Aydos, Allaniyaz, Allayar, Alpamıs, Koblan, Ayımxan, Gúlayım, Sárbinaz, and Zulfiya are interpreted in relation to particular historical figures, writers, statespersons, heroes, poets, or folkloric characters. This practice expresses the parents' desire for the child to resemble a respected social or spiritual ideal. The associations of Aydos with service to the people, Abbaz with poetry, Allayar Dosnazarov with a well-known figure, and Alpamys with heroism illustrate this model. In such cases, the name becomes a cultural bridge connecting historical memory with an envisioned future identity (Abdinazimov & Daniyarova, 2016; Sayımbetov, 2000).

Motives related to clan, tribal, geographical, and community affiliation are also important in anthropocentric interpretation. Some names indicate the clan to which a child belongs, the child's place of birth, or the maternal family's lineage. For example, Aksyngul may indicate affiliation with the Qazaqly clan, Aytbay with the Ayteke clan, Moynaqbay with birth in the Moynaq district, and Almagul or Almakhan with a connection to Alma-Ata. In these cases, the name functions as a symbol linking the individual to a community, region, or kinship network. The anthropocentric factor is therefore associated not only with individual identification but also with collective identity (Abdinazimov & Daniyarova, 2016; Sayımbetov, 2000).

Nicknames and evaluative naming constitute another anthropocentric layer of Karakalpak anthroponymy. In the literature, nicknames are treated as units that express a person's physical appearance, psychological state, character, or social attributes. Qalım pushıq refers to a small nose, Eset gúrre reflects an aspect of appearance, and Asan qayğı conveys the psychological state of grieving over the fate of the people. Nicknames such as "Erejep tentek," "Synshy biy," and "Ernazar alakóz" similarly embody the community's evaluation of an individual. Names and nicknames therefore function together as anthropocentric resources that construct a person's social image and describe that individual from the community's perspective (Aitbaeva, 2024).

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The use of affectionate forms in male and female names is another important manifestation of subjective-evaluative meaning. In female names such as Aiguljan, Biybijan, Ayımbiyke, Aybiybi, and Sárbiyke, elements such as jan, biyke, and biybi intensify meanings of affection and value. In male names, shortened and affectionate forms similarly express interpersonal closeness and familial intimacy. The principal motivations for shortening personal names are ease of pronunciation and affectionate usage (Jarimbetova, 2023, pp. 259–261). Some shortened forms may subsequently develop into independent names. This process shows that personal names also perform an emotional and expressive function in interpersonal relations.

Table 1 summarizes the results of the analysis.

No.	Anthropocentric factor	Description	Male names	Female names
1.	Parental intention	A Karakalpak personal name can encode parental wishes and project a desired future identity for the child.	Murat, Aymurat, Maqset, Dáwletyar, Kópjúrsin, Ómirzaq, Esbosın, Qabıl, Ońǵarbay	Nesiybeli, Úmitay, Dáwletbiyke, Rısgúl, Jaqsıgúl, Abadan, Abatgúl, Aydana
2.	Protective motif	Protective names are traditionally given to guard a child from the evil eye, malevolent spirits, and other perceived threats.	Amanbay, Amanlıq, Amantay, Amanjan, Amangeldi, Esen, Esengeldi	Amangúl, Ólmesxan, Tursınay, Jańılsın, Jańılxan, Jańılay, Esengúl
3.	Religious factor	In the religious layer of personal names, faith and human need are expressed as inseparable elements.	Qudiyar, Allambergen, Qudaybergen, Táńirbergen, Reyimbergen	Qatiysha, Fatiyma, Máryam, Aysha, Ayshagúl
4.	Family and life circumstances	These names record the circumstances of a child's birth as part of the family's biography.	Qırqbay, Eliwbay, Alpısbay, Jalǵasbay, Turjan, Turar	Toqtagúl, Turdıgúl, Genjegúl, Turdıxan
5.	Physical traits and birth circumstances	These names derive from a distinctive physical trait, birthmark, or circumstance observed at birth.	Qalbay, Qállibek, Oraqbay, Oralbay, Qarabay, Qosbarmaq	Qálbiyke, Anar, Meńligúl, Qarashash, Sarıgúl, Perijamal
6.	Gender factor	Gender functions not merely as a formal distinction but as a cultural ideal encoded in the name.	Azamat, Aybat, Aymırza, Batır, Bahadır, Ámir, Palwaniyaz, Quralbay, Qılıshbay	Dámexan, Dámetken, Ulmeken, Ulbosın, Ulboǵan
7.	Social and status-related motives	These names express the hope that the child will attain social standing, respect, authority, or material and spiritual well-being.	Tóremurat, Tórebay, Elmırza, Mırzabay, Mırzaǵalı, Xojabay, Sha(x)niyaz, Bekturdı	Xanzada, Xansulıw, Xanshayım, Aqshagúl, Biyke, Shaxsánem, Sha(x)zada
8.	Imitation of historical figures, heroes, and idealized images	The name creates a cultural link between historical memory and an envisioned future identity.	Aydos, Mamanbiy, Alpamıs, Qoblan, Allayar, Jánibek	Gúlayım, Sárbinaz, Tumaris, Gúlparshın
9.	Clan, tribal, geographical, and community affiliation	The name connects an individual with a clan, community, region, or kinship network.	Qıpshaqbay, Mańǵıtbay, Túrkmenbay, Tashkenbay, Qazaqbay	Few examples are attested

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No.	Anthropocentric factor	Description	Male names	Female names
10.	Nicknames and evaluative forms	Nicknames and affectionate forms express physical, psychological, characterological, or social attributes and perform emotional-evaluative functions in interpersonal relations.	Qalım pushıq, Eset gúrre, Erejep tentek, Ernazar alakóz; Ótesh, Allash, Sapash, Ernash, Jámet	Few female nicknames are attested. Biybijan, Sánemjan, Ulsha, Almash, Dámesh, Máriyash

The anthroponymic examples analyzed in this study were drawn from Abdinazimov and Daniyarova (2016), Aitbaeva (2024), Jarimbetova (2023), and Sayımbetov (2000).

DISCUSSION

Karakalpak anthroponymy has developed in close connection with the people's historical memory, customs, religious beliefs, family intentions, social experience, and national worldview. Karakalpak names encode anthropocentric meanings associated with protection, hope, attitudes toward children, gender differentiation, social evaluation, ethnocultural memory, and affective expression. Their lexical-semantic, morphological, and structural patterns also demonstrate the historical relationships of the Karakalpak people with Turkic, Arabic-Persian, Russian, and other cultural traditions. Karakalpak anthroponyms should therefore be understood not merely as units that identify individuals but as important linguocultural phenomena that reflect the complex relationships among people, language, society, and culture.

CONCLUSION

Anthropocentric factors are manifested in Karakalpak personal names in complex and multilayered forms. A name can function as a linguistic expression of the people's worldview, family strategies, religious beliefs, gender expectations, social ideals, historical memory, and everyday experience. Karakalpak anthroponymy should therefore be interpreted not only as a formal-semantic system but also as a human-centered cultural code. A name may reflect the circumstances of a child's birth, the parents' fears, hopes, and beliefs, and the community's evaluation of the individual. These characteristics make Karakalpak personal names a particularly rich source of data for anthropocentric analysis.

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A COMPETENCY-BASED ASSESSMENT FRAMEWORK FOR EVALUATING WEB TECHNOLOGY COMPETENCE IN HIGHER EDUCATION

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ABSTRACT

Web technology courses require students to integrate coding, interface design, data management, testing, documentation, teamwork, and independent learning. Yet assessment in such courses can become dominated by the functionality of a final product, leaving the quality of the development process and professional competencies insufficiently represented. This conceptual study proposes an operational competency-based assessment framework for project-oriented web technology courses in higher education. The framework was developed through a purposive conceptual synthesis of foundational work on constructive alignment, formative assessment, rubrics, project-based learning, digital competence, and self-regulated learning. It specifies five competency dimensions—technical, problem-solving, collaborative, communication, and self-development competence—together with observable indicators, evidence sources, assessment methods, a four-level rubric, an illustrative weighting model, and safeguards for moderation and fairness. The model treats assessment as a five-stage cycle: evidence collection, criterion-based judgement, competency-level determination, feedback and moderation, and improvement followed by reassessment. Because the framework has not yet been empirically validated, its weights and cut scores are presented as adaptable design defaults rather than universal standards. The paper offers instructors a transparent starting point for course-level implementation and defines a research agenda for content validation, inter-rater reliability testing, usability evaluation, and examination of learning effects.

ACCEPTED

02.08.26

Keywords: *competency-based assessment; web technology competence; higher education; project-based learning; analytic rubric; formative feedback.*

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1. Introduction

The rapid evolution of digital technologies has changed what higher education expects computing graduates to demonstrate. Knowledge of syntax, tools, and concepts remains necessary, but competent performance also requires learners to interpret requirements, select appropriate technologies, build maintainable solutions, communicate design decisions, collaborate with others, and continue learning as platforms and standards change. This broader expectation is consistent with competence-oriented education, which treats achievement as the integrated use of knowledge, skills, attitudes, and judgement in

meaningful contexts rather than as the reproduction of isolated information (Biggs & Tang, 2011; OECD, 2019; Voogt et al., 2013).

Web technology courses make this assessment problem particularly visible. A single project may involve front-end development, server-side logic, data storage, accessibility, testing, deployment, version control, documentation, and teamwork. A final website can therefore conceal important differences in how students reached the result. One group may produce a functional application through well-managed collaboration and systematic testing, whereas another may rely on one member, undocumented code, or late corrections that cannot be sustained. Assessing only the final product may reward surface completion while overlooking reasoning, contribution, communication, and capacity for improvement.

Project-based learning provides an authentic setting in which students can combine knowledge and practice, but its assessment is demanding. Evidence must be gathered across time and from different sources, criteria must be visible to learners, and judgements must remain sufficiently consistent across assessors and projects. Research on project-based learning indicates that outcomes and measures vary considerably across higher education settings, reinforcing the need to connect learning outcomes with explicit assessment evidence (Guo et al., 2020). Foundational work on formative assessment and rubrics similarly emphasizes that criteria and feedback should guide learning, not merely justify a final grade (Andrade, 2000; Black & Wiliam, 1998; Nicol & Macfarlane-Dick, 2006).

Existing digital competence frameworks provide useful descriptions of knowledge, skills, and attitudes, but they are generally broader than the course-level assessment of web development. DigComp 2.2, for example, offers a comprehensive citizen-oriented model of digital competence, while the UNESCO ICT Competency Framework for Teachers addresses professional use of technology in education (UNESCO, 2018; Vuorikari et al., 2022). These frameworks help establish the multidimensional nature of competence, yet an instructor still needs operational answers to four questions: What dimensions of web technology competence should be assessed? What evidence should count? How should performance levels be determined? How should feedback and reassessment be organized?

This paper addresses those questions by proposing a conceptual and operational framework for competency-based assessment in project-oriented web technology courses. Its contribution is not an empirically validated measurement instrument. Rather, it is a transparent design proposal that (a) defines five assessable dimensions, (b) links each dimension to observable evidence and appropriate assessment methods, (c) specifies a four-level rubric and an illustrative scoring rule, and (d) embeds grading within a continuous cycle of feedback, moderation, and improvement. The framework is intended to be adapted to local course outcomes and subsequently tested through expert review and classroom research.

2. Conceptual Foundations and Related Work

2.1 Competency-based and authentic assessment

Competency-based assessment begins with clearly stated outcomes and asks learners to demonstrate integrated performance against criteria. Constructive alignment requires the intended learning outcomes, learning activities, and assessment tasks to support one another (Biggs & Tang, 2011). In a web technology course, this means that an outcome such as “design and implement a secure data-driven application” should be assessed through evidence that actually shows design reasoning, implementation, testing, and explanation—not only through a written examination about those activities.

Authentic assessment is particularly relevant because competence is context-dependent. Project artefacts, demonstrations, code reviews, presentations, and reflective records can reveal different aspects of performance. Rubrics make those expectations visible by describing gradations of quality and can support both judgement and learning when students use them before and during task completion (Andrade, 2000). However, a rubric is not automatically reliable. Criteria must be sufficiently specific, assessors need shared interpretations, and representative examples are required for calibration.

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2.2 Project-based learning and multiple evidence sources

Project-based learning places students in extended tasks that usually culminate in a product, presentation, or solution. Its value lies partly in the integration of disciplinary knowledge, practical activity, collaboration, and reflection. Guo et al. (2020) found substantial variation in how project-based learning outcomes are conceptualized and measured in higher education. For assessment design, this variation implies that the final product should be accompanied by process evidence, including planning records, repository histories, testing documentation, individual explanations, and peer-contribution records.

No single evidence source is sufficient for every competency. Project evaluation is appropriate for functionality and quality of implementation; practical demonstration and oral questioning can confirm individual understanding; observation and peer evidence can inform collaboration; presentations and technical documents reveal communication; and portfolios or reflection logs can show self-regulation and improvement. Learning analytics may support evidence collection, but digital traces should be interpreted as indicators rather than treated as complete representations of learning (Long & Siemens, 2011).

2.3 Feedback, self-assessment, and self-regulated learning

Formative assessment is most useful when feedback clarifies the expected standard, identifies the gap between current and desired performance, and enables a subsequent action (Black & Wiliam, 1998; Nicol & Macfarlane-Dick, 2006). A competency framework should therefore do more than convert evidence into a grade. It should indicate which dimension requires improvement and provide an opportunity for the learner to apply that feedback in a revised artefact or later task.

Self-assessment and peer assessment can strengthen evaluative judgement, but they should not be used uncritically. Self-regulated learning involves forethought, performance monitoring, and reflection (Panadero, 2017; Zimmerman, 2002). In web projects, students can use checklists, progress logs, code review notes, and post-project reflections to make these processes visible. Nevertheless, self- and peer scores should be calibrated against shared criteria and should supplement rather than replace instructor judgement where high-stakes grades are concerned. Sustainable assessment also requires students to develop the capacity to judge quality beyond a single course (Boud & Falchikov, 2007).

3. Framework Development Approach

The framework was developed as a conceptual design synthesis rather than a systematic review or an empirical validation study. The source base was purposively organized around five bodies of work already relevant to the problem: constructive alignment and learning design (Biggs & Tang, 2011; Laurillard, 2012), formative assessment and feedback (Black & Wiliam, 1998; Nicol & Macfarlane-Dick, 2006), rubrics and sustainable assessment (Andrade, 2000; Boud & Falchikov, 2007), project-based and digital competence perspectives (Guo et al., 2020; UNESCO, 2018; Vuorikari et al., 2022; Zhao et al., 2021), and self-regulated learning (Panadero, 2017; Zimmerman, 2002). Broader future-oriented competence perspectives were used to ensure that technical performance was not treated as the sole outcome (OECD, 2019; Voogt et al., 2013).

Development proceeded through four design steps. First, the intended construct was bounded as competence demonstrated in the design, development, explanation, and improvement of web-based solutions within higher education coursework. Second, recurring outcome domains were grouped into five dimensions: technical, problem-solving, collaborative, communication, and self-development competence. Third, each dimension was translated into observable indicators and plausible evidence sources. Fourth, the components were assembled into a cyclical assessment process with performance levels, suggested scoring rules, feedback, and reassessment. The resulting framework was then checked for internal alignment: each dimension had to be linked to evidence, each evidence type to an assessment method, and each judgement to a feedback action.

Three design principles guided the synthesis. The first was *triangulation*: important judgements should draw on more than one form of evidence. The second was *transparency*: learners should receive

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criteria and level descriptors before undertaking the assessed task. The third was *developmental use*: assessment should produce an actionable improvement target and, where course regulations permit, an opportunity to demonstrate progress. These principles are theoretically grounded, but the specific dimensions, suggested weights, and cut scores remain propositions requiring validation.

4. Proposed Competency-Based Assessment Framework

The framework contains five interdependent components: competency dimensions, indicators and evidence, assessment methods, competency levels and scoring, and feedback with reassessment. Figure 1 presents these elements as a cycle. The cycle begins with planned evidence collection rather than with retrospective grading. Evidence is then judged against published criteria, translated into dimension-level and overall competency decisions, moderated where necessary, and used to guide improvement.

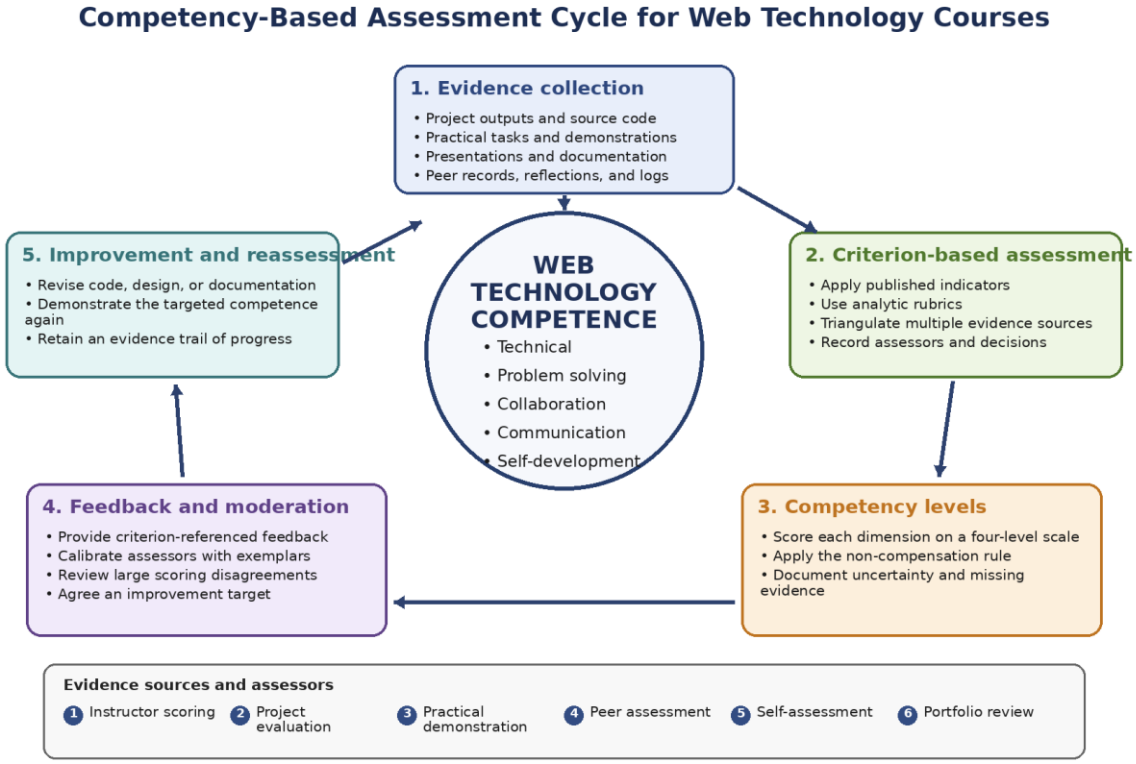


Figure 1. Competency-based assessment cycle for web technology courses.

4.1 Competency dimensions, evidence, and assessment methods

Table 1 operationalizes the five dimensions. The indicators are deliberately broad enough to be adapted across introductory and advanced courses, but each course should replace them with task-specific criteria. For example, “implementation quality” may emphasize standards-compliant HTML and CSS in an introductory course, while an advanced course may include architecture, security, testing, deployment, performance, and maintainability.

Table 1. Competency dimensions, indicators, evidence, and suggested weighting

Dimension	Observable indicators	Primary evidence and methods	Suggested weight
Technical competence	Functional correctness; code quality and maintainability; data handling; testing; accessibility, security, and deployment where relevant.	Project artefacts and source code; automated or manual tests; practical demonstration; instructor rubric.	35%
Problem-solving competence	Requirement analysis; decomposition; technology selection; design reasoning; debugging; evaluation of alternatives.	Design notes; issue records; code review; oral questioning; case or troubleshooting task.	25%

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Dimension	Observable indicators	Primary evidence and methods	Suggested weight
Collaborative competence	Role fulfilment; contribution; coordination; constructive review; responsible use of shared tools.	Repository and task records; observation; calibrated peer assessment; individual explanation.	15%
Communication competence	Clarity of presentation; technical documentation; explanation of design choices; audience-appropriate language.	Presentation; demonstration; README or technical report; rubric-based questioning.	15%
Self-development competence	Goal setting; response to feedback; independent learning; reflection; evidence of revision and transfer.	Portfolio; reflection log; before-and-after artefacts; self-assessment checked against evidence.	10%

The weighting profile in Table 1 is an illustrative default, not a validated standard. It gives technical and problem-solving competence greater influence because these dimensions represent core disciplinary performance, while preserving a meaningful contribution from collaboration, communication, and self-development. Departments may alter the weights to match course outcomes, but they should publish the chosen profile before assessment and avoid changing it after viewing student results.

4.2 Competency levels and rubric descriptors

A four-level analytic rubric is proposed to separate emerging, developing, proficient, and advanced performance. Instructors should write dimension-specific descriptors, but the general meanings in Table 2 can be used as a common template. The descriptors focus on independence, consistency, quality, justification, and transfer rather than on vague labels such as “poor” or “excellent.”

Table 2. General four-level competency rubric

Level	Score	General descriptor
1. Emerging	1	Performance is incomplete, heavily dependent on guidance, or inconsistent with essential criteria. The learner can reproduce limited procedures but cannot yet explain or apply them reliably.
2. Developing	2	Performance meets some essential criteria but contains important weaknesses. The learner completes familiar tasks with support and gives partial explanations of decisions.
3. Proficient	3	Performance consistently meets the essential criteria. The learner works with reasonable independence, justifies major decisions, identifies limitations, and responds effectively to feedback.
4. Advanced	4	Performance exceeds the essential criteria through well-justified choices, integration across dimensions, efficient or innovative solutions, critical evaluation, and transfer to less familiar conditions.

4.3 Scoring and decision rules

For each dimension, assessors first score the relevant criteria from 1 to 4 and calculate the mean criterion score. The suggested overall score is:

Overall competence = 0.35(Technical) + 0.25(Problem solving) + 0.15(Collaboration) + 0.15(Communication) + 0.10(Self-development)

The illustrative interpretation bands are 1.00–1.74 = Emerging, 1.75–2.49 = Developing, 2.50–3.24 = Proficient, and 3.25–4.00 = Advanced.

An overall average can conceal a serious weakness if strong communication or peer ratings compensate for deficient technical performance. The framework therefore includes a non-compensation rule: a learner cannot be classified as Proficient or Advanced overall unless both technical competence and problem-solving competence reach at least 2.50. Courses may identify additional threshold dimensions where safety, security, academic integrity, or professional accreditation requires them.

Self- and peer assessment should normally contribute no more than 20% of any high-stakes dimension score unless local validation demonstrates sufficient accuracy. Their principal value is

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developmental: they reveal contribution patterns, prompt reflection, and enable students to practise applying criteria. Where peer reports materially affect grades, the instructor should require specific evidence, examine outliers, and retain final responsibility for the decision.

4.4 Feedback, moderation, and reassessment

Feedback should be criterion-referenced and dimension-specific. Instead of stating only that a project is "good" or "weak," the assessor identifies the strongest evidence, the unmet criterion, and one feasible next action. A useful feedback record therefore contains three elements: the demonstrated level, the evidence on which the judgement was based, and the improvement target. This structure supports the feedback principles described by Nicol and Macfarlane-Dick (2006) and helps learners monitor their own progress.

Moderation is necessary when several instructors assess different projects or when scoring has substantial consequences. Before grading, assessors should discuss the rubric and independently score one or more sample projects. Large discrepancies should be resolved by examining the evidence and clarifying the descriptor, not merely by averaging scores. During implementation, a second assessor can review borderline cases, unusually high or low results, and a random sample. These procedures do not guarantee reliability, but they create an auditable basis for evaluating it.

Where course regulations allow, students should have an opportunity to act on feedback. Reassessment does not require unrestricted resubmission of an entire project. It may involve correcting a security flaw, rewriting documentation, explaining a design decision, completing an individual practical task, or submitting a reflection that connects feedback with revision. The reassessment task should target the deficient competency and generate new evidence rather than simply reward cosmetic changes.

5. Implementation Guidance

The framework can be implemented through the following sequence. First, instructors map course learning outcomes to the five dimensions and remove any dimension that is genuinely outside the course scope. Second, they define task-specific criteria and identify the evidence that will demonstrate each criterion. Third, learners receive the rubric, evidence requirements, weighting profile, and rules for individual accountability before beginning the project. Fourth, formative checkpoints are scheduled so that feedback can influence subsequent work. Fifth, assessors calibrate their interpretations using sample artefacts. Sixth, final decisions are recorded at criterion, dimension, and overall levels, with the evidence trail retained for review.

Table 3. Minimum implementation and quality-control requirements

Stage	Minimum requirement	Quality-control question
Planning	Map learning outcomes, dimensions, criteria, evidence, and weights.	Does every graded criterion correspond to a stated learning outcome and observable evidence?
Orientation	Provide the rubric, exemplars, deadlines, collaboration rules, and reassessment conditions.	Could a student explain what counts as Proficient before starting the task?
Evidence collection	Collect product, process, and individual evidence at planned checkpoints.	Is the evidence sufficient to distinguish team output from individual competence?
Judgement	Score criteria analytically and document the basis for borderline decisions.	Would another assessor be able to reconstruct why the level was assigned?
Moderation	Calibrate assessors and review discrepancies, outliers, and a sample of decisions.	Are disagreements used to improve the rubric and shared interpretation?
Feedback and improvement	Provide a targeted action and obtain new evidence after improvement where feasible.	Did the feedback lead to a demonstrable change rather than only a final grade?

Implementation should remain proportionate. An introductory course may use a small number of criteria and two major evidence points, whereas a capstone course may require a detailed rubric, repository

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analysis, individual defence, and formal moderation. The framework is compatible with digital portfolios and learning-management systems, but technology should serve the assessment design rather than determine it. Automated test results, repository statistics, and activity logs can support decisions, yet they cannot by themselves establish the quality of reasoning, collaboration, or learning.

Fairness also requires accessible tasks and multiple ways to demonstrate competence where the learning outcome permits. For example, communication competence may be shown through a live presentation, recorded demonstration, or structured technical explanation, provided the same criteria are applied. Group work should include a mechanism for individual accountability. Students should know how peer information will be used, how disagreements can be challenged, and how privacy will be protected.

6. Discussion

The proposed framework advances beyond a product-only model by treating web technology competence as multidimensional and evidence-based. Its central design choice is the separation of dimensions before aggregation. This makes strengths and weaknesses visible: a student may produce functional code but need substantial development in documentation or collaboration, while another may communicate effectively but lack independent technical control. A single undifferentiated project grade would obscure those patterns.

The framework also connects summative judgement with formative use. Black and Wiliam (1998) established the importance of assessment that informs learning, and Nicol and Macfarlane-Dick (2006) linked feedback with self-regulation. In the present model, feedback is not an optional comment added after scoring; it is a required stage that identifies a criterion, cites evidence, and directs a next action. This design is compatible with Laurillard's (2012) view of teaching as an iterative design process in which learners act, receive feedback, and refine performance.

A further contribution is the explicit treatment of evidence quality and assessor responsibility. Peer and self-assessment are retained because they can reveal contribution and support evaluative judgement, but their limits are acknowledged. Similarly, digital traces and analytics can help instructors monitor activity, yet they are not equated with competence (Long & Siemens, 2011). The framework therefore uses triangulation and moderation to reduce dependence on any single score source.

The model differs from broad digital competence frameworks in scale and purpose. DigComp 2.2 and the UNESCO framework offer wide-ranging descriptions of digital knowledge, skills, and attitudes (UNESCO, 2018; Vuorikari et al., 2022), whereas the present proposal translates a narrower course-level construct into assessable evidence and decision rules. This specialization is useful, but it also limits generalizability: the framework should not be presented as a universal standard for all computing programs or professional certification.

7. Limitations and Research Agenda

This study has four main limitations. First, the framework is conceptual and has not been tested with students, instructors, or employers. Second, the source base was purposive rather than systematic, so relevant assessment and computing-education literature may be absent. Third, the proposed dimensions and weights reflect a defensible design rationale but not empirical factor structure or stakeholder consensus. Fourth, the general rubric descriptors require course-specific elaboration before use; applying them without adaptation would create an appearance of precision without adequate content validity.

The next stage should begin with expert content validation. Specialists in web development, computing education, and educational assessment can rate the relevance and clarity of each dimension, criterion, descriptor, and evidence source. Cognitive interviews with instructors and students can identify ambiguous language. A classroom pilot should then examine feasibility, scoring time, missing evidence, student understanding, and the distribution of scores. Inter-rater reliability should be calculated using an appropriate coefficient for ordinal ratings, and disagreement patterns should be used to revise descriptors and exemplars.

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Subsequent research can test whether framework-guided assessment improves feedback use, project quality, self-regulation, or alignment between course results and independent practical performance. Researchers should also examine fairness across individual and group projects, introductory and advanced courses, and different institutional contexts. Only after such evidence is available should the proposed weights, thresholds, or claims of reliability be treated as more than provisional design choices.

8. Conclusion

This paper proposed an operational competency-based assessment framework for project-oriented web technology courses in higher education. The framework defines technical, problem-solving, collaborative, communication, and self-development competence; links each dimension to observable indicators and evidence; uses a four-level analytic rubric; and embeds scoring within a cycle of moderation, feedback, improvement, and reassessment. It also provides an illustrative weighting model and a non-compensation rule to prevent strong peripheral performance from masking inadequate core technical competence.

The framework should be understood as a transparent starting point rather than a validated instrument. Its practical value lies in making assessment assumptions explicit and auditable: instructors must specify what competence means, what evidence will count, how levels will be determined, and how learners can improve. Empirical validation, reliability testing, and contextual adaptation are necessary before the model can support strong claims about effectiveness, objectivity, or fairness.

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ENHANCING DIGITAL COMPETENCE IN NETWORK TECHNOLOGIES EDUCATION THROUGH RULE-BASED ADAPTIVE LEARNING AND WEB-BASED LEARNING ANALYTICS

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ABSTRACT
This exploratory quasi-experimental study examined a rule-based adaptive learning and web-based learning analytics framework in a university Network Technologies course. The framework combined diagnostic assessment, structured digital content, virtual network laboratories, automated feedback, activity monitoring, and competency-based evaluation. Over one academic semester, 124 undergraduate students were assigned to a control group and an experimental group of 62 students each. The reported pretest means were comparable (58.6 and 59.0), whereas the posttest means were 71.2 for the control group and 84.1 for the experimental group. The experimental group also showed fewer laboratory errors, shorter task-completion time, more independently completed tasks, and a higher proportion of on-time submissions. These results are interpreted descriptively because participant-level data, dispersion estimates, and validated measurement evidence were not available in the reported dataset. The framework should therefore be regarded as a promising instructional design rather than a validated artificial-intelligence system or a definitive causal intervention. Its practical value lies in linking repeated network practice with transparent, instructor-supervised feedback and early support. Future multisite studies should validate the assessment rubric, document implementation fidelity, and report effect sizes, confidence intervals, and ethical data-governance procedures.

ACCEPTED

02.08.26

Keywords: *digital competence; network technologies; learning analytics; adaptive learning; virtual laboratory; automated feedback; cybersecurity; responsible AI use.*

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Introduction

Digital competence extends beyond the ability to operate devices. It includes the confident, critical, safe, and responsible use of digital technologies for learning, work, communication, information management, and problem-solving (Vuorikari et al., 2022). In higher education, this competence is increasingly connected with students' capacity to learn independently, evaluate digital information, collaborate in online environments, and transfer technical knowledge to authentic professional tasks. Educators therefore need learning designs that connect knowledge acquisition with practice, reflection, and responsible technology use (Redecker, 2017).

Network Technologies is especially suitable for developing observable forms of digital competence because students must combine conceptual knowledge with configuration, testing, diagnosis, and security decisions. Typical course content includes network architecture, topologies, the OSI and TCP/IP models,

IPv4 and IPv6 addressing, switching, routing, network services, wireless communication, monitoring, virtualization, and cybersecurity (Cisco Networking Academy, 2020). Success in these areas depends not only on knowing terminology but also on identifying faults, testing alternative explanations, and documenting technical choices.

Adaptive educational systems use information about learners' performance or activity to modify content, task difficulty, sequencing, or feedback (Brusilovsky, 2001; Brusilovsky & Millán, 2007). Learning analytics can complement this process by making patterns of engagement, delay, repeated error, and help-seeking more visible to students and instructors (Ferguson, 2012; Ifenthaler & Yau, 2020). However, the educational value of analytics depends on the validity of the indicators, the transparency of decisions, and appropriate safeguards for student data (Pardo & Siemens, 2014; Slade & Prinsloo, 2013).

Artificial intelligence is often used as a broad label for automated educational technology, even when a system relies only on predetermined rules. Reviews of artificial intelligence in higher education have repeatedly called for clearer descriptions of the underlying technology, stronger evaluation designs, and greater educator involvement (Bond et al., 2024; Zawacki-Richter et al., 2019). The present study therefore describes the implemented mechanism as rule-based adaptive learning. It did not train or validate a machine-learning model. The term artificial intelligence is retained only when discussing students' responsible evaluation of AI-generated advice as part of digital competence.

The purpose of the study was to explore whether an integrated web-based framework could support digital competence development more effectively than conventional instruction in a university Network Technologies course. The evaluation focused on reported changes in overall competence scores, practical performance, task completion, independent work, and student perceptions. A second objective was to examine how transparent activity and error indicators could support instructor-supervised identification of students who might need additional assistance.

Methods

Research design and participants

The study used an exploratory quasi-experimental pretest–posttest design over one academic semester. A total of 124 undergraduate students enrolled in a university-level Network Technologies course participated. The control group and experimental group each included 62 students. Because the study record did not document random allocation, the design is treated as quasi-experimental rather than randomized. The control group received conventional instruction, while the experimental group used the web-based framework described below. Demographic covariates, attrition, instructor equivalence, and implementation-fidelity measures were not included in the reported analysis; these omissions are considered in the limitations.

Structure of the web-based framework

The framework integrated six components across the learning cycle: diagnostic assessment, structured content delivery, virtual network laboratories, rule-based adaptation, automated feedback, and instructor-facing learning analytics. The diagnostic component identified initial theoretical and practical readiness. The content component organized resources by module. The practical component enabled students to create, test, and revise network configurations. The analytics component summarized activity and error patterns. The adaptive component selected predefined forms of support or challenge according to recent performance. The evaluation component combined several course indicators into an operational Digital Competence Index.

Course content was divided into ten modules: network fundamentals; the OSI and TCP/IP models; IPv4, IPv6, and subnetting; switching; routing; network services; wireless networking; cybersecurity; monitoring and troubleshooting; and network design. Each module included an introduction, conceptual explanation, visual material, formative questions, a practical task, feedback, and reflection. The final module required students to design and justify a complete network solution.

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Table 1
Digital Competence Assessment Criteria

No.	Criterion	Main indicators	Weight
1	Theoretical knowledge	Models, protocols, terminology, and standards	15%
2	Network configuration	Correct setup of routers, switches, and services	25%
3	Problem-solving	Detection and correction of network failures	20%
4	Cybersecurity	Secure configuration and risk awareness	15%
5	Independent learning	Task completion with limited support	10%
6	Collaboration	Contribution to group tasks and technical discussion	5%
7	Responsible AI use	Verification and appropriate use of AI-generated output	10%
	Total		**100%**

Operational measures

The Digital Competence Index (DCI) was calculated from seven indicators converted to a 0–100 scale:

$$DCI_i = 0.15K_i + 0.25C_i + 0.20P_i + 0.15S_i + 0.10I_i + 0.05G_i + 0.10A_i$$

where K is theoretical knowledge, C network configuration, P problem-solving, S cybersecurity, I independent learning, G group collaboration, and A responsible AI use. Scores below 56 were categorized as basic, 56–70 as developing, 71–85 as proficient, and above 85 as advanced. These weights and thresholds were operational design choices for this course. They were not derived from psychometric validation and should not be interpreted as universal competence standards.

The platform also generated an activity score from login regularity (L), task completion (T), module engagement (M), deadline compliance (D), and participation in collaborative activities (G):

$$AS_i = 0.20L_i + 0.25T_i + 0.25M_i + 0.15D_i + 0.15G_i$$

The activity score was used as a monitoring indicator rather than a replacement for academic assessment. It helped distinguish, for example, a low-performing but active student from a low-performing student with limited activity and repeated missed deadlines.

Rule-based adaptation and feedback

The adaptive mechanism used predefined decision rules rather than a trained artificial-intelligence model. Recommendations were based on test performance, laboratory performance, error patterns, task-completion time, and requests for assistance. A module score below 60% triggered a concise explanation, visual support, and a simplified laboratory task. Scores from 60% to 79% triggered reinforcement activities at the same level. Scores of 80% or higher triggered a more complex troubleshooting or project-based task. The learner profile was updated after each major task, so students were not permanently assigned to fixed ability groups.

A learning-state score combined theoretical performance (T), practical performance (P), activity (A), and independence (R):

$$LS_i = 0.30T_i + 0.40P_i + 0.15A_i + 0.15R_i$$

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Practical performance received the largest weight because the course emphasized configuration, testing, and troubleshooting. Feedback was provided in levels: an initial prompt or reminder, a more specific hint, and, when necessary, a complete explanation reviewed by the instructor.

Learning analytics and risk flags

The platform recorded login frequency, time spent on modules, viewed resources, task-completion time, attempts, laboratory errors, hint requests, forum participation, and submission punctuality. The system used these indicators to produce a rule-based risk flag:

$$RS_i = 0.35(1 - Perf_i) + 0.25E_i + 0.20(1 - Act_i) + 0.20D_i$$

where Perf is current performance, E normalized error frequency, Act activity, and D the proportion of delayed tasks. Scores below 0.30 were categorized as low risk, 0.30–0.59 as moderate risk, and 0.60 or higher as high risk. These categories were heuristic alerts, not validated predictions. A high-risk flag prompted instructor review and possible additional practice, a simplified learning path, or individual consultation. The instructor retained responsibility for any intervention.

Statistical analysis

The analysis reported here was limited to descriptive statistics: group means, absolute change, relative change, task-process indicators, and frequency percentages. Relative change was calculated as:

$$\text{Relative change (\%)} = [(\text{posttest} - \text{pretest}) / \text{pretest}] \times 100$$

Participant-level scores, standard deviations, confidence intervals, and the full output required to reproduce an inferential test were not reported in the consolidated results. Accordingly, no causal or statistically significant group difference is claimed in this revised report. The findings should be interpreted as descriptive evidence from a pilot evaluation.

Results

Overall outcomes

The control and experimental groups began with similar reported pretest means of 58.6 and 59.0, respectively. At the end of the semester, the control-group mean was 71.2 and the experimental-group mean was 84.1. This represented an absolute increase of 12.6 points in the control group and 25.1 points in the experimental group. Relative change was 21.5% and 42.5%, respectively. Because measures of dispersion were unavailable, the difference is presented descriptively.

Table 2

Comparison of Main Reported Outcomes

No.	Indicator	Control group	Experimental group
1	Pretest mean score	58.6	59.0
2	Posttest mean score	71.2	84.1
3	Absolute change	12.6	25.1
4	Relative change	21.5%	42.5%
5	Average laboratory errors	4.4	2.2
6	Average task-completion time	45.1 min	35.7 min
7	Independently completed tasks	63.0%	86.2%
8	On-time submissions	68.4%	90.1%
9	Students at the advanced level	11.3%	35.5%
10	Students remaining at the basic level	12.9%	3.2%

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Note. The table reports aggregate descriptive values. Standard deviations, confidence intervals, and participant-level data were not available for reproducible inferential analysis.

Competence dimensions and process indicators

The largest reported differences were in network configuration and problem-solving. The mean network-configuration score was 86.7 in the experimental group and 69.4 in the control group. The corresponding problem-solving means were 85.2 and 68.8. Cybersecurity scores were 82.9 and 70.3. The experimental group also showed a reported 14.2-point advantage in independent learning, although the two underlying group means were not provided.

Process indicators followed the same descriptive pattern. The experimental group averaged 2.2 laboratory errors compared with 4.4 in the control group, completed tasks in 35.7 minutes compared with 45.1 minutes, and recorded higher percentages of independent completion and on-time submission. These measures suggest more efficient task performance, but the study did not report the distribution of these indicators or whether task difficulty and exposure were equivalent between groups.

Error patterns

The learning-analytics log classified more than 3,000 laboratory events. Common errors involved IP addressing, subnet masks, routing entries, inactive interfaces, VLAN mismatches, and incomplete security settings. The study record reported decreases in the experimental group of 47% for IP-addressing errors, 43% for routing errors, and 39% for security-related errors. Exact baseline and follow-up counts were not supplied, so these values are interpreted as descriptive platform summaries rather than independently reproducible rates.

The framework distinguished isolated errors from repeated patterns. An isolated error triggered a brief reminder, whereas repeated errors triggered additional explanatory material and practice. This distinction was intended to separate occasional inattention from a possible conceptual gap.

Student perceptions

The end-of-semester questionnaire indicated generally positive perceptions. Approximately 91% of respondents reported that the platform made progress easier to follow, about 88% considered the adaptive tasks appropriate for their level, and more than 85% believed that the system increased their independence. Some students expressed concern about the quantity of activity data collected, and some considered the feedback too general. The item wording, response scale, respondent count, and reliability evidence were not included in the reported materials; therefore, these percentages should be treated as indicative rather than as a validated attitude measure.

Discussion

The descriptive outcomes suggest that integrating virtual laboratories, structured feedback, and visible learning indicators may support digital competence development in a practical Network Technologies course. The strongest reported differences concerned configuration, troubleshooting, cybersecurity, independent completion, and task efficiency. These outcomes are educationally plausible because the framework increased opportunities for repeated practice, immediate error information, and differentiated follow-up. Adaptive systems can be useful when they connect learner information to specific instructional actions rather than merely displaying data (Brusilovsky & Millán, 2007; Ifenthaler & Yau, 2020).

The contribution of the framework lies less in technological novelty than in pedagogical integration. Content, practice, feedback, monitoring, and instructor review were placed in one workflow. A student with weak conceptual understanding could receive a different response from a student who understood the concept but made a syntax or configuration error. This distinction is difficult to maintain consistently through manual monitoring in larger classes. Nevertheless, the mechanism remained rule-based. Describing fixed thresholds as artificial intelligence would overstate the technology and make the study difficult to reproduce.

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The virtual laboratory appears central to the reported pattern. Network education requires students to configure systems, observe consequences, test alternatives, and correct errors. Physical laboratories remain important, but virtual environments can provide additional opportunities to repeat tasks and explore failure conditions without disrupting production equipment. The framework's staged feedback was designed as temporary scaffolding: students first received a prompt, then a more explicit hint, and only later a complete explanation. The reported decrease in errors and increase in independent completion are consistent with that instructional purpose, although the available data do not establish causation.

Learning analytics also created a more detailed view of the learning process. A correct final configuration may conceal many failed attempts or extensive assistance, whereas another student may reach the same result independently. Process indicators can therefore enrich assessment, but they should not be treated as direct measures of competence without validation. Activity can be affected by connectivity, device access, disability, work obligations, and other circumstances. Ethical learning analytics requires proportional data collection, understandable explanations, and meaningful human oversight (Pardo & Siemens, 2014; Sclater, 2016; Slade & Prinsloo, 2013).

Responsible AI use remained relevant as a competence outcome even though the adaptive platform itself was rule-based. Students increasingly encounter generative systems that can produce fluent but inaccurate technical explanations. A competent learner should compare automated advice with documentation, simulation output, and security requirements before applying it. Current guidance on AI in education similarly emphasizes critical evaluation, transparency, and educator responsibility (European Commission, 2022; Holmes et al., 2019).

The findings should be interpreted cautiously. First, the study involved one course in one institutional context and lasted one semester. Second, random assignment, demographic comparability, attrition, instructor equivalence, and implementation fidelity were not documented. Third, the competence weights and cut scores were not psychometrically validated. Fourth, standard deviations, confidence intervals, effect sizes, and participant-level data were unavailable, preventing reproducible inferential analysis. Fifth, the questionnaire lacked reported item and reliability information. Sixth, the risk score was a heuristic rule rather than a validated predictive model. Finally, formal ethics approval, consent procedures, data retention, and access-control details must be documented before publication. These limitations prevent definitive claims of effectiveness but do not eliminate the framework's value as a testable instructional design.

Future research should use multisite samples, preregistered outcomes, validated competence measures, and clearly documented control conditions. Baseline-adjusted models or group-by-time analyses should report exact test statistics, effect sizes, and confidence intervals. The risk-flag mechanism should be evaluated for calibration, sensitivity, specificity, and potential subgroup bias before it is used for consequential decisions. Qualitative interviews could also examine how students interpret feedback and monitoring. Such work would allow the framework to move from a promising pilot design toward a reproducible and ethically governed educational intervention.

Conclusion

This study developed and descriptively evaluated a web-based, rule-based adaptive learning framework for Network Technologies education. The framework combined diagnostic assessment, modular content, virtual laboratories, automated feedback, activity monitoring, and instructor-supervised risk flags. Across the reported aggregate indicators, the experimental group achieved a higher posttest mean, fewer laboratory errors, shorter completion time, more independent task completion, and more on-time submissions than the control group. The pattern suggests that integrated practice and feedback may support technical digital competence, particularly in configuration, troubleshooting, and cybersecurity.

The evidence does not yet justify a definitive causal claim or the classification of the platform as a validated artificial-intelligence system. The principal contribution is a transparent instructional framework

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that can be tested and improved. Its responsible use requires validated measures, complete statistical reporting, human oversight, explainable rules, and documented protection of student data. With these conditions and stronger multisite evaluation, the framework may offer a practical model for technology courses in which competence depends on repeated performance, diagnosis, reflection, and responsible use of automated assistance.

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FORMATIVE ASSESSMENT IN SPECIALIZED SCHOOLS IN UZBEKISTAN: A PILOT STUDY OF PRACTICES, BARRIERS, AND CONDITIONS FOR SCALING

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ABSTRACT

This article examines formative assessment practices in one specialized school and two Presidential Schools in Uzbekistan, as well as the organizational conditions that should be considered when transferring selected practices to the broader general secondary education system. The study employs a pilot, multi-source, predominantly qualitative design supported by descriptive quantitative evidence. The empirical material comprises 12 structured lesson observations, 15 semi-structured interviews with teachers, six focus groups with students in Grades 9–11 (n = 24), and 45 samples of written feedback. The mean descriptive score on the author-developed observation scale was 4.7 out of 7; systematic student involvement in self-assessment emerged as the weakest domain. Explicit self-assessment or peer-assessment procedures based on criteria were observed in 4 of the 12 lessons. Of the 45 written comments, 18 (40.0%) focused on the performance process or self-regulation, whereas 11 (24.4%) consisted of general evaluations of the learner or effort without specific instructional information. Students valued specific comments while simultaneously maintaining a strong orientation toward marks. Through comparison across data sources, a conceptual four-phase scaling model is proposed: diagnostic piloting, contextual adaptation, controlled expansion, and institutionalization. The findings do not permit an assessment of the causal effect of formative assessment on human-potential development, but they identify practical conditions for its more consistent implementation.

ACCEPTED

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Keywords: *formative assessment, pedagogical feedback, self-assessment, assessment literacy, specialized schools, education policy, Uzbekistan.*

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Introduction

Amid digitalization, changes in the structure of employment, and growing expectations for independent learning, education systems increasingly associate the quality of schooling not only with the acquisition of subject content but also with students' capacity to plan, monitor, and adjust their own learning. The Education Policy Outlook 2025 describes this capacity through a combination of will, skills, and means that enable individuals to continue learning throughout life (OECD, 2025a). Formative assessment can support such learner agency when information about students' current understanding is used to modify the subsequent actions of teachers, students themselves, or their peers.

The classic definition offered by Black and Wiliam (1998) emphasizes the functional rather than instrumental nature of formative assessment: the central issue is not whether a separate test, rubric, or

comment is present, but whether the information obtained is used to improve subsequent learning. The authors later connected formative assessment to a broader theory of pedagogy and to interactions among the teacher, the learner, and the subject matter (Black & Wiliam, 2018). Formative quality, therefore, does not arise automatically from an international curriculum, a digital platform, or a new reporting system.

This issue is particularly relevant to Uzbekistan because of the rapid expansion of Presidential and specialized schools, the introduction of international curricula, and the simultaneous objective of improving the quality of mainstream general education. Government documents report a substantial increase in funding for the school sector, the creation of additional school places, and greater attention to teacher development and quality assessment (President of the Republic of Uzbekistan, 2025). Nevertheless, the availability of infrastructure and curricula does not guarantee an equivalent depth of change in classroom practice.

The original version of the study combined overly broad claims concerning human-potential development, national policy, and the effectiveness of formative assessment. The present revised version retains the central idea but restricts its conclusions to what is directly supported by the data presented: feedback practices, student participation, perceptions of assessment, and implementation conditions in the three selected institutions.

The purpose of the study is to describe how formative assessment is implemented in selected specialized schools in Uzbekistan, identify recurring barriers and enabling conditions, and use this evidence to propose a cautious conceptual model for further scaling.

The study addresses three research questions:

1. Which formative assessment practices are observed during lessons and in written feedback?
2. How do teachers and students perceive the strengths and limitations of these practices?
3. Which conditions should be considered when transferring formative assessment practices beyond the pilot institutions?

2. Theoretical Foundations

2.1. Formative Assessment as a Process of Using Evidence of Learning

Formative assessment should be distinguished from frequent testing and from the mere provision of comments. Assessment becomes formative only when evidence of a student’s current understanding leads to a justified next step. Such a step may involve modifying an explanation, regrouping students, repeating a task, setting an individual goal, conducting criterion-referenced self-assessment, or adjusting a problem-solving strategy.

Bennett (2011) cautions that generalized claims about the effectiveness of formative assessment often conceal differences among specific techniques, the quality of their implementation, and the conditions in which they are applied. Accordingly, analysis of practice should focus not on the presence of an isolated technique but on the complete sequence: learning goal, evidence elicitation, interpretation, and action. A break between information collection and subsequent action frequently reduces formative assessment to a procedural formality.

Cambridge International defines assessment for learning as an approach embedded in teaching and learning that enables teachers and students to answer three questions: where the learner is going, where the learner is now, and how the gap between current and expected performance can be closed (Cambridge University Press & Assessment, 2025). This approach requires clear goals and criteria, effective questioning, the use of evidence of learning, and the development of learner autonomy.

2.2. Feedback, Self-Assessment, and Self-Regulation

The model developed by Hattie and Timperley (2007) distinguishes feedback directed at the task, the process, self-regulation, and the self. Task-level feedback can help correct a specific error, but its transfer to new situations is limited. Process-level feedback explains the strategy or reasoning underlying performance, whereas self-regulation feedback supports planning, self-checking, and the adjustment of

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actions. General praise or criticism directed at the person, without reference to a criterion, usually provides students with little information about what to do next.

A meta-analysis of educational feedback demonstrates that its effects are heterogeneous and depend on its content, level, and mode of use (Wisniewski, Zierer, & Hattie, 2020). Similarly, self-assessment has its most consistent influence not when students are simply asked to "assess themselves," but when it is connected to criteria, reflection, and the subsequent revision of work (Panadero, Jönsson, & Botella, 2017). The present study therefore considers not only whether a comment is provided, but also whether it can support the learner's next instructional action.

2.3. Scaling and the Context of Implementation

Scaling a pedagogical practice is not a matter of mechanically copying an instrument from one school to another. Research indicates that change depends on teachers' assessment literacy, the quality of materials, local marking policies, opportunities for professional collaboration, and leadership support (Evans, 2022). The OECD (2025b) likewise treats formative assessment and feedback as practices whose quality depends on the school environment and professional support. In less-resourced or examination-oriented contexts, international ideas may be reinterpreted, reduced to their external form, or brought into conflict with established expectations among teachers and students (Chen, Zhang, & Li, 2021).

Improvement in formative practice generally results from a combination of strategies rather than the introduction of a single technique. Andersson and Palm (2017) show that meaningful changes include clarifying goals, systematically eliciting evidence of learning, using criteria, activating students, and adapting teaching. Scaling should therefore assess not the number of training sessions delivered or rubrics distributed, but the quality of changes in everyday classroom interactions.

Table 1

Key Conditions for Implementing Formative Assessment Identified in the Literature

Condition	Description	Risk if Absent
Assessment literacy	Understanding of goals, criteria, evidence of learning, and forms of subsequent action.	Reduction of formative assessment to a test, mark, or general praise.
Alignment of materials	Rubrics, tasks, and criteria are connected to learning objectives and the actual course content.	Fragmented techniques that do not influence teaching.
Time and collaboration	Teachers have opportunities to discuss student work and plan instructional adjustments.	Collection of data that cannot be used because of workload pressures.
Leadership support	School leaders encourage safe experimentation and do not use formative data as a punitive control mechanism.	Compliance-oriented implementation and resistance.
Active student role	Students understand criteria, use feedback, and participate in self-assessment.	Passive receipt of comments without any change in action.

3. National and Institutional Context

Since 2017, school education in Uzbekistan has undergone an intensive period of institutional renewal. According to official data, by 2025 funding for preschool and school education had increased sevenfold, approximately one million additional school places had been created, and the system of supplementary teacher payments had begun to reflect qualifications, language proficiency, and the results of professional appraisal (President of the Republic of Uzbekistan, 2025). The 2023–2026 Partnership

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Compact for Education Reform similarly emphasizes the need to expand infrastructure, develop the teaching workforce, and improve the assessment of learning (UNICEF, 2023).

Presidential and specialized schools serve as sites for implementing advanced curricula, contemporary teaching methods, and international approaches to assessment. Part of the network has received Cambridge International accreditation and delivers IGCSE and A Level programmes (Agency for the Development of Presidential, Creative, and Specialized Schools, n.d.). However, institutions within this network differ in their histories, staffing profiles, curricula, and access to external professional support. They should therefore not be treated as a homogeneous model.

The transferability of these practices is particularly important for the mainstream system. Specialized schools use selective admission, have comparatively more favourable resources, and operate within a different professional environment. Their experience may therefore provide hypotheses and prototypes, but it does not constitute direct evidence that the same results will be obtained in ordinary schools without contextual adaptation.

4. Methodology

4.1. Research Design

The study was conducted as a pilot, multi-source investigation with a predominantly qualitative design and descriptive quantitative support. It is neither an experiment nor a national monitoring exercise or a representative comparison of schools. Quantitative indicators are used to summarize the observed cases rather than to support causal conclusions or statistical generalization to the education system as a whole.

Data were collected between February and May 2026 in three institutions: one specialized institution in Tashkent and two Presidential Schools in Samarkand and Namangan. The institutions were selected purposively to provide variation in geographical and institutional context. This form of sampling does not provide statistical representativeness.

4.2. Participants and Data Sources

Table 2

Composition of the Empirical Material

Source	Volume	Distribution	Purpose
Lesson observations	12 lessons	Four in each institution; mathematics, science, and English	Description of feedback, self-assessment, and instructional adaptation practices
Teacher interviews	15 interviews	Five in each institution	Identification of perceptions, barriers, and enabling conditions
Focus groups	6 groups; n = 24	Two groups in each institution; Grades 9–11; 13 girls	Analysis of perceptions of marks, comments, self-assessment, and motivation
Written feedback	45 samples	15 from each institution	Classification of the level and instructional orientation of comments

The interviewed teachers had a mean teaching experience of 8.4 years (SD = 3.2). According to the source dataset, 11 of the 15 teachers had completed professional learning related to Cambridge programmes, while four had experience working in international schools outside Uzbekistan.

4.3. Instruments

Lesson observations employed an author-developed pilot scale comprising eight indicators scored from 1 (“not observed”) to 7 (“consistent, high-quality practice”). The indicators were conceptually linked

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to the literature on learning goals and criteria, feedback quality, self-assessment, peer assessment, instructional adaptation, self-regulation, and emotional safety (Black & Wiliam, 2018; Hattie & Timperley, 2007; Cambridge University Press & Assessment, 2025). The scale is not an official CLASS instrument and has no externally validated thresholds. Scores are therefore interpreted descriptively only.

The semi-structured teacher interviews addressed understandings of formative assessment, typical techniques, the use of criteria, time constraints, the influence of school policy, and professional support. Student focus groups explored how students received information about errors, the comparative value of marks and comments, experiences of self-assessment, and the motivational consequences of assessment.

Written comments were classified according to the four levels in Hattie and Timperley's (2007) model: task, process, self-regulation, and self. Process- and self-regulation-level comments were treated as the most transferable to subsequent action; task-level comments were regarded as useful but limited to a specific error; and general praise or criticism without instructional guidance was classified as low in informational value.

4.4. Data Analysis

The interviews and focus groups were transcribed and analyzed thematically in NVivo 14 using Braun and Clarke's (2006) six-phase procedure. Quantitative characteristics of the observations and artefacts were summarized in SPSS 29 using frequencies, proportions, means, and standard deviations. Because of the small sample and its nested structure, inferential statistics were not used in the revised version.

Data sources were integrated during interpretation: observed practices were compared with teacher and student accounts and with the content of written feedback. Convergence across multiple sources was treated as strengthening an interpretation, but not as evidence of causality.

4.5. Ethical and Methodological Limitations of the Procedure

The source documentation reports ethical approval under Protocol No. 045 dated 15 March 2026. The findings are presented in aggregate form, without identifying students or teachers.

The observations and coding were conducted as part of a pilot project; independent double coding and an assessment of inter-rater reliability were not reported. This limits the reproducibility of categorical decisions. In addition, observations of 12 lessons cannot distinguish stable institutional differences from the characteristics of particular teachers, subjects, or observation days.

5. Results

5.1. Observed Formative Assessment Practices

The mean descriptive score on the author-developed observation scale was 4.7 out of 7. The highest mean score was obtained for feedback quality (4.9), followed by the adaptability of instructional decisions (4.8). Student involvement in self-assessment received the lowest mean score (4.4). These values should not be interpreted as normative levels of quality because the scale has no externally validated thresholds.

Mean scores differed across institutions: Tashkent, 5.4; Samarkand, 4.5; and Namangan, 4.2. With only four observations per institution, these differences are descriptive. They may reflect a combination of teacher characteristics, subjects, class composition, and access to professional support, but they do not permit the effect to be attributed to the institution itself.

Structured self-assessment or peer assessment using explicit criteria was observed in 4 of the 12 lessons (33.3%). In the remaining cases, students were more often recipients of comments than participants in interpreting criteria or setting a subsequent goal. This distinction is important: the presence of oral feedback alone does not demonstrate the development of students' capacity to use feedback independently.

Teachers used rubrics and specified errors in tasks most consistently. A complete formative cycle—in which the information obtained directly changed the subsequent task, the pace of the lesson, or an individual learner strategy—was observed less frequently.

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Table 3

Descriptive Observation Results by Formative Assessment Domain (N = 12)

Domain	Tashkent (n = 4)	Samarkand (n = 4)	Namangan (n = 4)	Overall (N = 12)
Feedback quality	5.6	4.8	4.3	4.9
Involvement in self-assessment	5.2	4.2	3.9	4.4
Adaptability of decisions	5.5	4.5	4.4	4.8
Overall mean score	5.4	4.5	4.2	4.7

5.2. Student Perceptions

The focus groups revealed a dual orientation among students. Nineteen of the 24 participants (79.2%) stated that they would prefer to receive specific comments more frequently instead of a mark alone. At the same time, 14 students (58.3%) reported that a mark motivated them more strongly than a comment. These proportions describe the statements of focus-group participants and are not results from a representative survey.

This duality may be related to the competitive educational environment: a comment helps students understand what should be improved, whereas a mark remains a readily understood symbol of status and progress. A transition toward a formative culture therefore requires not the abolition of summative assessment, but a clear separation of functions: a mark records performance at a particular stage, whereas a comment directs subsequent action.

5.3. Quality of Written Feedback

Table 4

Classification of Written Feedback by Level (N = 45)

Level	n	%	Example	Interpretation
Task	16	35.6	“Incorrect; review the formula on p. 24.”	Specific, but limited to the current error.
Process	8	17.8	“The method was appropriate, but the error occurred during the calculation stage.”	Helps the student understand the performance strategy.
Self-regulation	10	22.2	“Before submission, check the logical sequence of your arguments.”	Supports planning and self-checking.
Self	11	24.4	“Well done!” / “You need to try harder.”	Does not indicate exactly what or how to improve.
Total	45	100.0	—	—

Process- and self-regulation-level comments together accounted for 18 of the 45 samples (40.0%). This combined category was identified in the source materials as having the greatest formative value. A further 16 comments (35.6%) indicated correctness or error in a specific task but did not always explain how the guidance could be transferred to subsequent work. Eleven comments (24.4%) consisted of general praise or an exhortation to make greater effort.

The artefacts confirm the observed pattern: teachers frequently provide information about an error, but less often formulate comments in a way that enables the learner to plan the next step independently.

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5.4. Comparison Across Data Sources

Comparison of the observations, focus groups, and written materials revealed three recurring patterns. First, formative techniques were present, but their completeness varied: criteria and rubrics were used more frequently than procedures supporting student self-regulation. Second, students understood the value of explanatory comments, yet the institutional importance of marks continued to exert a strong influence on motivation. Third, the quality of practice was related not only to the school's formal curriculum but also to the professional decisions of individual teachers and the support available to them.

These findings do not demonstrate that specialized schools are superior to general schools because no common comparative instrument or primary data from the mainstream system were available. They show that even in a relatively favourable environment, formative assessment remains a complex practice requiring pedagogical, organizational, and cultural support.

6. Discussion

6.1. From the Presence of Instruments to the Use of Information

The first finding is that the use of rubrics and comments does not in itself constitute a complete formative cycle. The results are consistent with Bennett's (2011) critique: effects depend on how evidence of learning is interpreted and translated into action. In the observed lessons, information about the quality of current work was more prominent than students' active use of that information.

The second finding concerns the level of feedback. Comments directed at the process and self-regulation accounted for 40.0% of the sample. This does not imply that the remaining comments were useless; identifying an error may be necessary. Without an explanation of the strategy or the next step, however, the learner remains dependent on the teacher. Such dependence limits the connection between formative assessment and the broader objective of developing learner autonomy.

The third finding is the continued strong role of marks. Students' desire for substantive comments coexisted with their recognition of the stronger motivational force of numerical or categorical marks. This duality demonstrates that formative and summative assessment should not be presented as a simple opposition. The task is to ensure functional clarity and coherence: summative assessment may record achievement, but it should not displace the information required for improvement.

6.2. Conditions for Scaling

Five critical conditions were identified on the basis of the literature and the pilot findings. They constitute an analytical proposal rather than an empirically validated national model.

1. Practice-oriented teacher assessment literacy. Professional learning should include collaborative analysis of authentic student work, formulation of criteria, design of feedback comments, and planning of the next step, rather than only familiarization with terminology.
2. Coherence between formative and summative requirements. National marking practices, school reporting requirements, and curriculum pacing should not encourage teachers to collect information that cannot be used to modify learning.
3. Organizational time and professional collaboration. Teachers need regular opportunities to discuss criteria, compare samples, and revise tasks. Without such opportunities, formative assessment increases workload but does not necessarily improve instructional decisions.
4. Student assessment literacy. Students should be taught to understand criteria, distinguish between the quality of their work and judgments of themselves as persons, use feedback, and set verifiable goals.
5. Context-sensitive monitoring. Monitoring should assess not the number of rubrics or training sessions, but the quality of feedback, student participation, and actual changes in subsequent teaching.

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6.3. A Conceptual Model for Phased Expansion

Table 5

A Four-Phase Conceptual Model for Scaling

Phase	Purpose	Key Actions	Indicators of Readiness
1. Diagnostic piloting	Understand existing practice and constraints.	Lesson observations; analysis of student work; interviews; agreement on a minimum set of indicators.	A baseline picture of practices and local barriers is available.
2. Contextual adaptation	Test instruments under authentic conditions.	Co-development of criteria; small cycles of trial implementation; workload analysis; student training in self-assessment.	Teachers and students can use criteria without continuous external support.
3. Controlled expansion	Transfer the practice to diverse schools.	Cluster-based implementation; mentors; comparable observations; adjustment of materials by school type.	Quality is maintained across several contexts rather than only in the original institutions.
4. Institutionalization	Embed the practice in sustainable systems.	Alignment with appraisal and curricula; preparation of new teachers; regular moderation; monitoring of feedback use.	The practice is supported by rules, resources, and professional communities.

The model operates simultaneously at four levels: policy establishes coherent requirements; agencies and institutions provide materials and professional learning; the school creates time, leadership, and a culture of collaboration; and the classroom translates criteria and feedback into specific actions by teachers and students. Failure at any level may produce formal implementation without a change in learning.

For Uzbekistan, the most rational next step is not the immediate nationwide prescription of a single instrument, but a series of comparable pilots in urban, rural, single-shift, and double-shift schools. Specialized institutions may serve as centres of professional support, but materials should be co-developed and tested with teachers from the mainstream system.

6.4. Study Limitations

The study has five principal limitations. First, the sample was small and purposively selected; the findings do not represent all Presidential, specialized, or general schools. Second, four observations per institution do not permit reliable assessment of stable differences among schools. Third, the author-developed observation scale has not undergone independent psychometric validation, and inter-rater reliability was not reported. Fourth, the focus-group proportions are based on a small number of participants and are influenced by group dynamics. Fifth, the study did not measure changes in students' academic, metacognitive, or socio-emotional outcomes.

The findings should therefore be understood as a description of practices and implementation conditions, rather than as evidence of effectiveness or a causal influence on human potential. Testing such effects would require validated baseline and outcome measures, comparable groups, and a longer period of observation.

7. Conclusion

The pilot study indicates that formative assessment is already represented in the selected specialized institutions in Uzbekistan through rubrics, the specification of errors, and selected forms of instructional adaptation. Nevertheless, students' active use of criteria and feedback remains the most vulnerable component. Only 4 of the 12 observed lessons included explicit self-assessment or peer assessment based on criteria, while 40.0% of written comments focused on the process or self-regulation.

The principal practical conclusion is that scaling should concern not a set of external techniques but schools' capacity to transform evidence of learning into subsequent action. This requires assessment

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literacy among teachers and students, coherence with the summative assessment system, time for collaborative work, leadership support, and monitoring of the actual use of feedback.

The proposed four-phase model—diagnostic piloting, contextual adaptation, controlled expansion, and institutionalization—provides a sequence for further testing. Future studies should include a more diverse range of schools, independent coding of observations, validated instruments, and longitudinal indicators of learning outcomes. Only then will it be possible to evaluate with sufficient justification the contribution of formative assessment to the broader development of students' human potential.

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Appendix A. Pilot Study Instruments

A.1. Student Focus-Group Protocol

1. How do you usually learn about your mistakes and successes in your studies: through a mark, a teacher's comment, self-checking, or a classmate's assessment?
2. Which is more important to you: receiving a mark or receiving an explanation of what and how to improve? Why?
3. Give an example of a situation in which a teacher's comment helped you understand a topic better or improve your work.
4. Do you ever receive a mark without understanding exactly why it was awarded?
5. Do you use criteria or self-assessment before submitting your work? If so, how?
6. Does assessment in your school help you learn, or does it mainly indicate comparative performance? Explain your answer.

A.2. Author-Developed Pilot Observation Scale

Scale: 1—not observed; 2—isolated occurrence; 3—sometimes; 4—regularly; 5—consistently; 6—high quality; 7—consistent exemplary practice. The scores have no externally validated normative thresholds.

1. The teacher provides specific feedback on the content of the work rather than merely stating "correct/incorrect."
2. Feedback is aligned with the learning objective and success criterion.
3. The teacher uses a rubric, model, or other clear criteria.
4. Students use criteria for self-assessment.
5. Students participate in peer assessment under clear procedures.
6. The teacher modifies the next stage of instruction on the basis of the evidence of learning obtained.
7. Feedback includes guidance on planning, self-checking, or self-regulation.
8. Errors are discussed in an emotionally safe environment and used as a resource for learning.

A.3. Written Feedback Analysis Scale

- Task level: identifies correctness, an error, or a specific element of the current task.
- Process level: explains the strategy, method, reasoning, or cause of an error.
- Self-regulation level: guides planning, monitoring, self-checking, or the revision of subsequent work.
- Self level: contains general praise or an evaluation of the student without reference to a learning objective, criterion, or next action.

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PEDAGOGICAL FOUNDATIONS FOR DEVELOPING ENTREPRENEURIAL COMPETENCE IN VOCATIONAL EDUCATION: A CONCEPTUAL FRAMEWORK FOR DUAL EDUCATION

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ABSTRACT

This conceptual paper examines the pedagogical foundations required to develop entrepreneurial competence among students in vocational education, with particular attention to dual education and the integration of school- and workplace-based learning. The paper replaces unsupported empirical claims with a transparent focused narrative review of authoritative vocational-education frameworks and relevant peer-reviewed studies. The synthesis identifies six interdependent foundations: competence-oriented learning outcomes; curriculum integration; action-based and project-based pedagogy; coherent coordination between school and workplace learning; guidance, mentoring, and institutional support; and authentic assessment combined with continuous programme improvement. On this basis, a staged implementation model is proposed in which students move from opportunity recognition to idea development, validation, resource planning, implementation, and reflection. The model treats entrepreneurship not only as business creation but also as the capacity to transform ideas into economic, social, or cultural value. The analysis argues that isolated courses, occasional competitions, and general motivational activities are insufficient unless they are connected to vocational specialisms, employer participation, structured advisory services, and evidence-based assessment. The paper concludes that entrepreneurial competence should be embedded across the vocational learning ecosystem and supported by trained teachers, workplace mentors, accessible guidance, and institutional leadership.

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Keywords:
entrepreneurial competence; vocational education and training; dual education; entrepreneurial learning; career guidance; experiential pedagogy.

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Introduction

Vocational education and training (VET) is expected to prepare learners not only for entry into existing occupations but also for changing forms of work, self-employment, innovation, and value creation. This expectation has become especially important where young people face uncertain labour-market transitions and where vocational graduates may need to combine employment, freelance activity, and small-enterprise development during their careers. Entrepreneurship education in VET should therefore be understood more broadly than instruction in how to register and manage a business. It concerns the development of initiative, opportunity recognition, creativity, responsible risk management, collaboration, resource mobilisation, and the capacity to act on ideas.

The European Entrepreneurship Competence Framework, commonly known as EntreComp, defines entrepreneurship as acting upon opportunities and ideas in order to create value for others. Its three broad competence areas—Ideas and Opportunities, Resources, and Into Action—provide a useful basis for organising entrepreneurial learning across disciplines and educational levels (Bacigalupo et al., 2016). This broad conception is particularly suitable for vocational education because students can create value through improvements in products, services, production processes, customer relations, community projects, or new ventures. It also avoids treating entrepreneurship as relevant only to students enrolled in business, finance, or economics.

International guidance increasingly presents entrepreneurial learning as an institutional responsibility rather than a single subject. UNESCO-UNEVOC (2020) describes entrepreneurial TVET institutions as learning ecosystems in which curriculum, teaching methods, partnerships, resources, assessment, leadership, and organisational culture reinforce one another. Cedefop's (2023) European synthesis likewise shows that entrepreneurship competence is developed most effectively when policy, provider leadership, teacher capacity, work-based learning, stakeholder collaboration, and student support are aligned. These perspectives shift attention from whether a course called "Entrepreneurship" exists to whether students repeatedly encounter opportunities to practise entrepreneurial behaviour throughout their vocational preparation.

Research also indicates that the pedagogical design of entrepreneurship education matters. Traditional transmission-oriented teaching can communicate terminology and business procedures, but entrepreneurial action involves uncertainty, iteration, judgement, and learning from feedback. Neck and Greene (2011) therefore argue for teaching entrepreneurship as a method through practice, experimentation, and reflection. A systematic review by Nabi et al. (2017) found that entrepreneurship education produces varied outcomes and that stronger research and programme design are needed to connect teaching methods with intended learning results. In vocational settings, the issue is even more specific: students must connect entrepreneurial competence to an occupational field and to actual conditions in workplaces, markets, and communities.

The supplied manuscript originally framed the topic as an interview study, but it did not provide verifiable information about participants, countries, recruitment, ethics, transcripts, or data analysis. The present version therefore does not claim primary empirical findings. Instead, it reconstructs the paper as a conceptual review that asks: What pedagogical foundations are required for the systematic development of entrepreneurial competence in vocational and dual education? The objective is to integrate established frameworks and selected empirical literature into a practical model for vocational colleges, technical schools, teachers, workplace mentors, guidance specialists, and institutional leaders.

2. Method and Scope

This paper uses a focused narrative-review approach. It synthesises authoritative framework documents on entrepreneurial learning and vocational education together with selected peer-reviewed studies directly relevant to entrepreneurship competence, experiential pedagogy, career guidance, institutional support, and the integration of school- and workplace-based learning. The purpose is conceptual development rather than exhaustive or systematic evidence aggregation.

Sources were retained when they contributed to at least one of four analytical questions: how entrepreneurial competence is defined; which pedagogical methods are appropriate; how entrepreneurship can be integrated into vocational and dual education; and which institutional conditions support implementation. Authoritative sources include the EntreComp framework (Bacigalupo et al., 2016), the UNESCO-UNEVOC practical guide for entrepreneurial TVET institutions (UNESCO-UNEVOC, 2020), Cedefop's European synthesis (Cedefop, 2023), and OECD work on future-ready VET systems (OECD, 2023). Peer-reviewed studies were used to clarify pedagogy, competence exposure, career guidance, dual-learning coherence, and institutional support.

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The review is intentionally bounded. It does not estimate effect sizes, claim comprehensive coverage of all countries, or present the framework as empirically validated in a particular national system. The synthesis is analytical: recurring requirements across the selected literature were grouped into six pedagogical foundations and then organised into a staged implementation model. This transparent limitation is necessary because a conceptual paper must distinguish between evidence reported in previous research and proposals developed by the author.

3. Conceptualising Entrepreneurial Competence in Vocational Education

Entrepreneurial competence combines knowledge, skills, attitudes, and action. Business knowledge may include basic finance, accounting, marketing, customer relations, legal forms, and business planning. Transferable skills include communication, creativity, problem solving, negotiation, teamwork, leadership, and decision making. Attitudinal dimensions include initiative, persistence, self-efficacy, responsibility, and willingness to learn from uncertainty. These components are related but should not be treated as interchangeable.

Recent work in vocational education illustrates the importance of distinguishing what students are exposed to from what they ultimately achieve. Mack et al. (2024) developed the Vocational Education Entrepreneurship Knowledge and Skills scale to assess students' exposure to business knowledge and soft skills in TVET. Their distinction is valuable for programme evaluation: an institution cannot reasonably attribute entrepreneurial outcomes to its curriculum without first establishing whether students regularly encounter the intended knowledge and skills. Exposure, however, is only a starting point. Students also need opportunities to apply, integrate, and demonstrate competence.

Entrepreneurship education can pursue at least three related purposes. First, it can develop an entrepreneurial mindset that supports initiative and adaptability in employment and civic life. Second, it can prepare learners to create and manage a venture. Third, it can support actual venture creation through practice, incubation, finance, and mentoring. UNESCO-UNEVOC (2020) treats these purposes as overlapping rather than mutually exclusive. A vocational programme may begin with mindset development, move to occupationally grounded project work, and provide more intensive venture support to students whose ideas become feasible.

This broad understanding also strengthens inclusion. Entrepreneurial learning should not be restricted to students already perceived as confident, commercially oriented, or academically successful. Nor should it be concentrated only in traditionally business-related fields. Ferreras-García et al. (2021) show the multidimensional character of entrepreneurial competence, while the EntreComp framework explicitly applies across educational and occupational contexts. In VET, a student in construction, agriculture, mechanics, information technology, hospitality, design, health services, or another field can learn to recognise needs, improve a service, organise resources, communicate value, and test an idea.

Career guidance is part of this competence-development process. Studies of career education and guidance show that students benefit when employability and career-management learning are made visible, structured, and accessible rather than left to individual initiative (Aranda et al., 2021; Helens-Hart, 2019). Romero-García and Suárez-Ortega (2024) further connect professional guidance with the development of entrepreneurial competence in educational settings. In vocational education, guidance should help students interpret their occupational strengths, identify possible markets and employment pathways, evaluate risk, and decide whether self-employment or enterprise development is appropriate for their circumstances.

4. Six Pedagogical Foundations

4.1 Competence-oriented learning outcomes

Entrepreneurial learning must begin with explicit outcomes. Vague objectives such as "developing entrepreneurial spirit" are difficult to teach and assess. Outcomes should specify what learners will be able to recognise, produce, decide, communicate, and evaluate. EntreComp offers a structured reference, but institutions should translate broad competence areas into outcomes appropriate to each vocational field.

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For example, a hospitality student may identify an unmet customer need, calculate the basic costs of a service improvement, test the idea with potential users, and present a feasible proposal. An automotive student may identify a recurring maintenance problem, design a service solution, estimate resources, and communicate value to customers. These are entrepreneurial performances even when no new company is immediately created. Clear outcomes also allow teachers of general subjects, vocational specialists, and workplace mentors to understand their complementary roles.

4.2 Curriculum integration

A stand-alone entrepreneurship course can provide essential concepts, but it is rarely sufficient on its own. Entrepreneurial competence should also be embedded within occupational modules, practical training, projects, and work placements. This approach creates repeated exposure and helps students understand that entrepreneurship is connected to technical quality, customer needs, productivity, safety, sustainability, and professional ethics.

Curriculum integration requires deliberate mapping. Institutions should identify where each competence is introduced, practised, demonstrated, and revisited. Business knowledge can be taught through dedicated modules, while communication, opportunity recognition, cost calculation, problem solving, and project management can be reinforced in vocational tasks. Cedefop (2023) indicates that entrepreneurship competence is more sustainable when it is embedded across the learning ecosystem rather than dependent on isolated initiatives by individual teachers.

Institutional orientation also matters. Balasubramanian et al. (2020), although working in the university context, show that entrepreneurial orientation operates at an organisational level. For vocational institutions, this means leadership should support experimentation, external partnerships, teacher collaboration, student projects, and responsible use of resources. Without organisational support, curriculum integration can remain a formal statement that is not enacted in classrooms or workshops.

4.3 Action-based and project-based pedagogy

Entrepreneurial competence develops through purposeful action. Students need to investigate problems, generate alternatives, make decisions with incomplete information, interact with users, manage resources, and reflect on results. Suitable methods include occupationally grounded projects, simulations, design challenges, student enterprises, service-learning, case-based problem solving, prototyping, market interviews, pitching, budgeting tasks, and reflective portfolios.

Neck and Greene (2011) distinguish teaching entrepreneurship as a method from teaching only about entrepreneurship. This distinction is central to vocational education. Students should not merely memorise the sections of a business plan; they should make and justify decisions, revise assumptions, and experience the consequences of choices. Reflection is essential because activity alone does not guarantee learning. Teachers should require students to explain what changed, which evidence influenced a decision, what failed, and how the next attempt would differ.

Project authenticity should be calibrated to the learner’s stage. Beginners may work with structured cases and small problems. Intermediate students can conduct user research, calculate costs, and test prototypes. Advanced students can complete interdisciplinary projects with employers, community organisations, or actual customers. The objective is progressive independence, not the premature expectation that every learner must launch a business.

4.4 Coherence between school- and workplace-based learning

Dual education creates a strong setting for entrepreneurial learning because students encounter both formal instruction and real production or service contexts. Yet the existence of two learning venues does not automatically produce integration. Eiríksdóttir (2020) found that school- and workplace-based learning can operate in parallel rather than as a coherent programme when communication and pedagogical coordination are weak.

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Entrepreneurial projects should therefore connect the two venues intentionally. Before a placement, students can identify an occupational problem or opportunity and prepare observation questions. During workplace learning, they can collect non-confidential evidence, consult mentors, and examine technical, customer, and organisational constraints. Afterward, they can analyse the opportunity at school, develop a proposal, and receive feedback from both teachers and workplace partners. This sequence turns workplace exposure into a structured learning cycle.

Workplace mentors require clear guidance. Their role is not merely to supervise attendance or task completion. They can model professional judgement, explain customer expectations, provide feedback on feasibility, and expose students to the commercial and organisational dimensions of a trade. Teachers, in turn, help students connect experience to concepts, ethical considerations, and reflective analysis. Shared rubrics and scheduled communication can reduce fragmentation.

4.5 Guidance, mentoring, and institutional support

Students may have technical ability and promising ideas but lack confidence, information, networks, or knowledge of support services. Guidance should therefore be visible, accessible, and connected to the curriculum. A student should know where to obtain help with idea validation, financial planning, grants, legal structures, intellectual property, marketing, and career decisions.

Guidance specialists should avoid assuming that entrepreneurship is the correct pathway for every learner. Their task is to support informed choice. This includes helping students assess personal goals, occupational competence, market evidence, financial risk, family responsibilities, and alternative career routes. Career education is most useful when it expands realistic options rather than presenting business creation as a universal solution.

Mentoring can be provided by teachers, entrepreneurs, alumni, employer partners, financial specialists, and local development organisations. However, occasional motivational talks are not a substitute for sustained support. Effective mentoring requires continuity, role clarity, and a connection to the student's project stage. Institutions should also ensure that students outside business-related programmes and students from underrepresented groups can access support on equal terms.

4.6 Authentic assessment and continuous improvement

Assessment should capture what students can do, not only what they can recall. Appropriate evidence may include opportunity analyses, customer or user interviews, prototypes, cost calculations, project plans, risk registers, pitches, reflective journals, team evaluations, and implementation reports. Rubrics should address both process and product, including creativity, evidence use, feasibility, communication, collaboration, ethical judgement, and reflection.

Not every project should be evaluated according to commercial success. A failed prototype may demonstrate strong learning if the student collected evidence, recognised weaknesses, revised assumptions, and explained the next step. Conversely, an attractive presentation should not receive high marks when it lacks technical quality or market evidence. Assessment must reward disciplined learning rather than confidence alone.

Programme evaluation should examine curriculum exposure, teaching quality, participation, progression, student experience, and longer-term outcomes. Mack et al. (2024) provide one example of measuring exposure to business knowledge and soft skills. Institutions may combine such measures with project rubrics, student feedback, employer feedback, participation data, and follow-up information on employment, further education, self-employment, or venture activity. Continuous improvement should be based on evidence rather than the number of events or competitions organised.

5. A Staged Implementation Model

The six foundations can be operationalised through a staged learning cycle. The stages are not strictly linear: students may return to earlier decisions when new evidence appears. The model is intended to connect classroom learning, workplace experience, guidance, and assessment.

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Stage	Core student task	Typical learning activities	Main support	Evidence for assessment
1. Explore	Identify needs, problems, or opportunities connected to the vocational field.	Observation, problem mapping, interviews, occupational cases.	Vocational teacher and workplace mentor.	Opportunity brief and evidence log.
2. Develop	Generate and compare possible solutions.	Ideation, design tasks, teamwork, technical consultation.	Teacher, peers, and subject specialists.	Concept alternatives and selection rationale.
3. Validate	Test assumptions with users, customers, employers, or community stakeholders.	Prototype testing, feedback interviews, small experiments.	Guidance specialist, employer partner, potential users.	Validation report and revised value proposition.
4. Plan	Determine resources, costs, risks, legal considerations, and responsibilities.	Budgeting, business-model work, scheduling, risk analysis.	Business teacher, finance/legal advisers, mentor.	Feasibility plan, budget, and risk register.
5. Implement	Deliver a pilot, service, product, process improvement, or simulated venture.	Work-based project, student enterprise, service learning.	Teacher-workplace mentor team.	Product/service evidence and implementation record.
6. Reflect and progress	Evaluate results and decide whether to revise, stop, scale, or transfer learning.	Portfolio review, presentation, peer and mentor feedback.	Assessment panel and career guidance.	Reflective report, competence profile, and next-step plan.

Note. The model is a conceptual synthesis developed in this paper from the reviewed frameworks and studies.

6. Discussion

The framework addresses a recurring weakness in entrepreneurship education: the tendency to treat entrepreneurial competence as the result of a single course, motivational event, or competition. Such activities may raise awareness, but they do not ensure progressive competence development. A pedagogically coherent approach requires outcomes, repeated practice, occupational relevance, feedback, reflection, and institutional support.

The relationship between vocational competence and entrepreneurial competence should be complementary. Entrepreneurship education must not displace the development of technical expertise. A weak technical product or unsafe service does not become viable because it is accompanied by an attractive pitch. At the same time, technical competence alone may not enable a graduate to recognise customer needs, calculate costs, communicate value, or organise resources. The central task is integration.

Dual education offers distinctive opportunities for this integration. Workplace settings expose students to real constraints, professional standards, customer relations, teamwork, and resource decisions. Schools provide protected space for conceptual understanding, experimentation, critical reflection, and learning from mistakes. When the two venues communicate, students can connect occupational experience to entrepreneurial analysis. When they do not, students may experience entrepreneurship as an unrelated classroom topic.

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The framework also positions guidance as a pedagogical function rather than an administrative service at the end of a programme. Students need support while they form ideas, assess feasibility, and make career decisions. This is consistent with career-education literature that emphasises the importance of structured support and students' awareness of available services (Aranda et al., 2021; Helens-Hart, 2019). Guidance should be closely linked to projects and workplace learning, while preserving the student's autonomy.

An inclusive approach is essential. Claims that gender inequality or other barriers are absent cannot be made without appropriate evidence. Institutions should instead monitor participation, access to mentoring, project leadership, funding opportunities, and outcomes across relevant groups. Equal access requires transparent selection procedures, diverse role models, accessible schedules, and active efforts to ensure that support does not reach only the most confident students.

Finally, programme evaluation should distinguish immediate educational outcomes from later economic outcomes. A course may improve knowledge, self-efficacy, opportunity recognition, or project competence without producing immediate business start-ups. Conversely, a new venture may depend on many factors outside the institution. Evaluation should therefore use a sequence of indicators, from exposure and learning performance to transition outcomes and sustained entrepreneurial activity.

7. Implications for Policy and Institutional Management

At policy level, entrepreneurial competence should be expressed through clear VET learning outcomes and qualification requirements while allowing adaptation to occupational and regional contexts. Policy should not be limited to requiring an entrepreneurship subject. It should support teacher development, work-based learning partnerships, guidance services, assessment resources, and mechanisms for institutional improvement.

At provider level, leadership should establish a cross-functional team that includes vocational teachers, general-subject teachers, guidance specialists, employer representatives, and where appropriate student or alumni voices. The team should map existing provision, identify gaps, coordinate projects, develop assessment tools, and monitor implementation. UNESCO-UNEVOC (2020) emphasises that entrepreneurial learning requires organisational development, stakeholder participation, resources, and monitoring, not merely curriculum content.

Teacher professional development should combine entrepreneurial knowledge with pedagogy. Teachers need opportunities to experience project design, user research, basic financial reasoning, mentoring, reflective assessment, and collaboration with employers. Workplace mentors also need concise training and clear expectations. Without shared language and tools, the school and workplace may evaluate different things.

Institutions should create a visible pathway of support. All students may receive foundational entrepreneurial learning, while those with viable projects may progress to specialised mentoring, incubation, finance advice, or external partnerships. This tiered approach avoids imposing venture creation on every learner while ensuring that promising projects receive appropriate assistance.

Resource decisions should favour continuity over spectacle. A modest, well-coordinated programme with repeated project cycles, trained staff, accessible guidance, and reliable assessment is more educationally valuable than isolated high-profile events. Competitions can contribute to learning when they are embedded within a broader curriculum and when feedback is available to students whose projects do not win.

8. Limitations and Directions for Future Research

This paper is a focused conceptual review rather than a systematic review or empirical study. The proposed framework is informed by authoritative international guidance and selected research, but it has not been tested in a specific national VET system. Its relevance may vary according to institutional

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resources, labour-market structures, regulation, cultural expectations, and the organisation of dual education.

Future research should validate the framework through transparent empirical designs. Useful studies could include curriculum mapping across vocational fields; surveys of students' exposure to entrepreneurial knowledge and skills; interviews with students, teachers, guidance specialists, and workplace mentors; observation of project-based learning; and longitudinal tracking of educational and employment outcomes. Cross-national studies should report sampling, language, translation, ethics, and analytical procedures in sufficient detail.

Experimental or quasi-experimental work should avoid relying only on entrepreneurial intention. Studies should assess actual competence performance, quality of project decisions, transfer to workplace tasks, and delayed outcomes. Research should also examine differential access and outcomes by gender, socioeconomic background, disability, field of study, and location. Such evidence would help determine which elements of the framework are most effective, for whom, and under which institutional conditions.

9. Conclusion

Developing entrepreneurial competence in vocational education requires more than teaching students how to write a business plan. It requires a coherent pedagogical system in which students identify opportunities, mobilise knowledge and resources, act on ideas, receive feedback, and reflect on results within their occupational fields.

This paper identifies six foundations for that system: explicit competence-oriented outcomes; curriculum integration; action-based pedagogy; coordination between school and workplace learning; guidance and mentoring; and authentic assessment linked to continuous improvement. Together, these foundations support a staged progression from opportunity recognition to implementation and reflective career decision making.

The central implication is that entrepreneurial learning should be embedded across the vocational institution. Teachers, workplace mentors, guidance specialists, managers, and external partners have distinct but connected responsibilities. When these elements operate coherently, vocational education can prepare students not only to enter the labour market but also to improve workplaces, create value, respond to uncertainty, and pursue responsible self-employment or enterprise development where appropriate.

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THEORETICAL FOUNDATIONS AND INTERNATIONAL EXPERIENCE OF DEVELOPING THE HUMAN CAPITAL OF TALENTED YOUTH

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ABSTRACT

This article treats the development of talented youth as an educational-management problem rather than a selection exercise. It combines human capital theory, developmental accounts of giftedness and strategic talent management in one analytical framework. The state-supported architectures of Singapore, the Republic of Korea, Israel, Russia and Kazakhstan are examined through a structured, focused comparison covering six dimensions: public mandate, governance, identification, development provision, data and evaluation, and equity and adaptation. The findings are presented as five evidence-based design propositions rather than causal laws. Durable systems tend to rest on a stable public mandate, a lead authority with defined interorganizational responsibilities, alignment between identification and service capacity, a data-evaluation-feedback cycle, and a formal capacity to revise policy. The article then assesses the institutional design established in Uzbekistan under Presidential Decree No. PF-86. It proposes a longitudinal participant registry, capacity-linked admissions, repeated and domain-sensitive entry routes, equity indicators, staged evaluation and post-programme pathways. These measures would allow the emerging initiative to learn from its first cohorts without copying any foreign model in full.

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Keywords: *educational management; human capital; talented youth; gifted education; talent management; comparative policy analysis; monitoring and evaluation; Uzbekistan.*



Introduction

The economic meaning of education changed when knowledge, skills and health came to be treated as productive assets rather than as residual social benefits. Smith placed acquired abilities within fixed capital [1]. Schultz later recast expenditure on education and health as investment [2], while Becker developed an economic account of general and specific human capital [3]. Mincer supplied an empirical framework for estimating the relationship between schooling, experience and earnings [4]. Endogenous-growth models subsequently showed how learning, research capacity and knowledge spillovers can sustain productivity growth beyond the contribution of physical capital alone [5, 6]. At the policy level, the World Bank Human Capital Index and OECD education indicators have strengthened the demand for measurable links between public expenditure, learning and future productive capacity [7, 8].

Talented youth occupy a small but strategically consequential part of this agenda. Their potential is uncertain, domain-specific and sensitive to the environment in which it develops. Natural aptitude does not yield expertise through selection alone. Gagné's model describes talent as the outcome of a developmental process that transforms ability through learning, practice and environmental catalysts [9]. Subotnik, Olszewski-Kubilius and Worrell likewise place giftedness on a trajectory from potential to competence, expertise and, in rare cases, eminent

performance [10]. A public system therefore has to manage a sequence: noticing potential, validating it fairly, providing appropriate opportunities, supporting transitions and learning from later outcomes.

Uzbekistan entered a new phase of system building with Presidential Decree No. PF-86 of 15 May 2025, which established the “President’s Talented Children” initiative and its national governance arrangements [11]. The initiative creates an opportunity to connect school-age identification with advanced preparation, specialised schooling and a community of graduates. It also raises familiar management questions. How many students can the development infrastructure serve? Which institution owns the participant journey across programmes and years? How should regional, linguistic and socioeconomic access be assessed? Which outcomes would justify continuation or redesign?

The article addresses three research questions. First, what theoretical principles follow when human capital, giftedness and talent management are read together? Second, which institutional design patterns recur across established national systems? Third, how can those patterns inform the implementation and evaluation of Uzbekistan’s emerging architecture? The contribution is analytical rather than classificatory. The countries are not ranked, and institutional continuity is not equated with educational effectiveness. The comparison instead identifies design propositions that can be examined through later administrative and outcome data.

2. Theoretical framework

2.1. Human capital: investment, time and return

Human capital theory supplies two propositions relevant to talented youth. The first concerns time. Education produces returns over long periods, often after several transitions between school, higher education and employment. A programme assessed only through immediate examination results may therefore confuse an intermediate output with the investment return. The second concerns opportunity cost. Resources allocated to a selective programme cannot be justified by the label “investment” alone; the programme must demonstrate additional value, distributional legitimacy and a credible connection to later capability.

The theory does not imply that every form of selective education has a positive return. Becker’s distinction between general and specific human capital is useful here [3]. Some competencies remain transferable across institutions and occupations; others are tied to a narrow programme, contest or admission route. A national strategy should favour development that broadens durable capabilities - analytical reasoning, disciplinary depth, research practice, communication, self-regulation and collaboration - while avoiding an excessive dependence on short-lived selection formats.

Measurement also requires restraint. The Human Capital Index estimates the future productivity of a child through population-level education and health measures [7]; it is not a tool for attributing national growth to a gifted programme. OECD indicators provide comparative information on participation, attainment, finance and system performance [8], but they do not isolate the causal effect of selective provision. For talented-youth policy, the defensible sequence is narrower: define intended capabilities, follow participant progression, compare outcomes with suitable benchmarks, and record costs and distributional effects.

2.2. Giftedness as a developmental and domain-sensitive construct

Early gifted-education practice often relied on general cognitive testing and fixed thresholds. The Marland Report broadened the policy definition by recognising intellectual ability, specific academic aptitude, creativity, leadership, visual and performing arts, and psychomotor ability [12]. Renzulli’s three-ring conception placed gifted behaviour at the intersection of above-average ability, creativity and task commitment [13]. The Munich Model similarly treated achievement as the product of several ability factors, non-cognitive characteristics and environmental conditions [14].

These accounts alter the management problem. A single test can identify performance under specified conditions, but it cannot exhaust the domains in which potential may emerge. Age matters because the predictive value of indicators changes across development. Domain matters because mathematical, artistic, athletic and leadership potential are expressed differently. Opportunity matters because prior access shapes observed achievement. A defensible identification system therefore uses several sources of evidence, permits entry at more than one age, distinguishes potential from prior training and provides an appeal or re-entry route.

The developmental view also clarifies why selection and provision must be planned together. The identification decision creates an expectation of suitable education. If service places, trained staff or mentoring capacity are unavailable, the system produces a formal status without a developmental pathway. Conversely, an

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inclusive school-based provision can develop a broad group while more intensive programmes remain available for students who need greater depth. The design question is not whether a system should be inclusive or selective in the abstract; it is how levels of provision correspond to demonstrated need.

2.3. Strategic talent management and public governance

Strategic talent management shifts attention from isolated high performers to the positions, capabilities and institutional processes that matter for an organisation's future. Collings and Mellahi define the field through the identification of strategically important positions, the development of talent pools and a differentiated human-resource architecture [15]. At national scale, macro talent management adds education, migration, labour-market institutions, research systems and public policy to the analysis [16]. The Global Talent Competitiveness Index reflects this broader concern with countries' capacity to enable, attract, grow and retain talent [17].

The public sector introduces a coordination problem that corporate models often understate. Ministries, schools, universities, research institutes, local authorities, families and employers hold different resources and incentives. Bryson's account of public strategy places stakeholder management and implementation capacity at the centre of strategic planning [18]. Mintzberg's critique of formal planning is equally relevant: a strategy is not validated by the existence of a document; it is validated when organisations can adjust action in response to experience [19].

Taken together, the three theoretical lines suggest an integrated management cycle. Human capital theory asks what capabilities are being built and how their return will be assessed. Developmental theories of giftedness require repeated, domain-sensitive opportunities. Strategic talent management specifies governance, differentiated provision and transition pathways. The cycle is completed only when data from participation, progression, equity and outcomes return to the institutions that can change policy.

3. Research design

3.1. Comparative approach and case selection

The study uses a qualitative structured, focused comparison. In this approach, every case is examined through the same set of questions, while the researcher retains enough contextual detail to avoid treating formally similar institutions as equivalent [20]. The method is appropriate because the available evidence consists mainly of laws, policy documents, administrative descriptions and scholarly case studies rather than harmonised outcome data.

The five cases were selected purposively. Singapore and Israel show long-running systems in small, highly urbanised states. The Republic of Korea combines legislation, national and regional governance, research capacity and an integrated database. Russia illustrates a national centre linked to a regional network rather than a ministry-only model. Kazakhstan offers a post-Soviet administrative context and a presidentially initiated specialised centre with direct relevance to Uzbekistan. The cases provide variation in legal form, centralisation, identification and service delivery while retaining a common focus on state-supported education for school-age high-ability learners.

3.2. Sources, coding and analytical dimensions

The source corpus contains official laws and government webpages, materials published by coordinating institutions, and peer-reviewed or scholarly literature available up to 5 August 2026. Official sources were used to establish current mandates, governance arrangements, selection procedures and programme forms. Scholarly sources were used to interpret historical development and reported limitations. No confidential administrative records or participant-level data were used.

Each case was coded against six questions: (1) What public instrument authorises the system? (2) Which body leads policy, and how are responsibilities distributed? (3) How are learners identified, and can they enter through more than one route or at more than one point? (4) What forms of development follow identification? (5) What data, evaluation and feedback mechanisms are visible? (6) How does the system address access, adaptation or revision? A claim was retained in the cross-case analysis only when it could be traced to a cited source and applied through the same question to all five cases.

3.3. Operational definition and limits of inference

The dependent concept is termed institutional continuity and adaptive capacity rather than sustainability. It refers to a system's ability to maintain a public mandate across time, coordinate a participant pathway, align service capacity with entry, collect information on implementation and outcomes, and revise its design when evidence or social conditions change. This definition does not assume that a durable institution is effective or equitable.

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Educational effectiveness would require comparable outcome data and an identification strategy capable of separating programme effects from prior advantage.

The comparison is exploratory. Different countries publish data for different years and with different definitions. Official webpages describe formal arrangements more reliably than implementation quality. The study cannot rank national systems, estimate causal effects or judge cost-effectiveness. Its claims are design propositions for policy development and later testing.

3.4. Author positionality

The author is employed by the Agency for Specialized Educational Institutions and works in the unit responsible for implementing the "President's Talented Children" initiative. This position provides direct knowledge of the policy setting but may also influence the interpretation of institutional readiness. To reduce that risk, the Uzbekistan assessment is limited to publicly available instruments and separates formal provisions from demonstrated operating capacity. The analysis and recommendations are the author's scholarly judgement and should not be read as an official position of the Agency.

4. International cases

4.1. Singapore: from a narrow central programme to layered provision

Singapore introduced the Gifted Education Programme (GEP) in 1984 after preparatory work by a specialised Ministry of Education unit [23]. Under the current programme, students are identified through a two-stage exercise in Primary 3 and selected learners enter an enriched curriculum in Primary 4 [24]. The programme has served approximately one per cent of a cohort in nine primary schools [21]. Its design combined central assessment, teacher preparation, curriculum development and concentrated provision.

The reform announced in August 2024 does not amount to an immediate closure. It applies to the 2024 Primary 1 cohort, which reaches Primary 4 in 2027 [21]. The Ministry's 2026 implementation update states that the existing GEP will cease admitting new Primary 4 students from 2027, while existing classes continue until the final cohort completes Primary 6 in 2028 [22]. All primary schools will expand school-based extensions and after-school programmes; around ten per cent of the cohort is expected to benefit. Students requiring further stretch may attend weekly advanced modules in English, mathematics or science at fifteen designated centres.

The refreshed identification process retains a common assessment but removes the second central selection stage. Schools may add teacher observation and student work, and learners can be identified again at the end of semesters in Primary 4 and Primary 5 [22]. The case shows a move from one narrow gate and school transfer toward layered provision, domain-specific extension and repeated entry. The policy remains centrally designed, but development is distributed more widely.

4.2. Republic of Korea: statutory architecture, differentiated institutions and an integrated database

The Republic of Korea created a statutory basis through the Gifted Education Promotion Act, enacted in 2000 and effective from March 2002. The Act defines gifted schools, gifted classes, gifted education centres and gifted education research institutes [25]. It establishes a Central Committee in the Ministry of Education and regional committees in city and provincial education offices. This is a coordinated multi-level structure rather than a single institution.

The Act permits selection across general intelligence, specific academic aptitude, creative thinking, artistic talent, physical talent and other special abilities. It also authorises separate measures for learners whose potential has not developed because of socioeconomic disadvantage or residence in vulnerable areas [25]. Provision is differentiated among specialised schools, classes in ordinary schools and centres attached to education offices, universities or research institutions. The legal framework requires continuity between educational levels and allows curriculum recognition and credit linkage.

Research and information infrastructure form a distinctive part of the Korean arrangement. The Act assigns research institutes responsibility for policy research, identification tools, teacher training, support systems and the construction and management of integrated gifted-education databases [25]. The KEDI-operated Gifted Education Database (GED) supports applications, teacher recommendations, institutional information, learner records, online programmes and national statistics [26]. Its 2025 dashboard reported 63,167 learners, 1,267 institutions and 16,611 teachers involved in gifted education [26]. Historical analysis also documents the use of national master plans and the gradual expansion of science-oriented provision [27].

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Korea offers the clearest formal connection between governance, differentiated provision, research and data. Its limitation for international transfer is equally clear: legal completeness does not show that identification is free from social bias or that all programme types produce comparable outcomes. The infrastructure creates the capacity to evaluate; it does not substitute for evaluation.

4.3. Israel: national reach, psychometric thresholds and diverse programmes

Israel operates a national identification process through the Ministry of Education's Department for Gifted and Outstanding Students. For the 2026/27 admissions cycle, the Ministry retained a two-stage process in official schools. Stage A is administered in Grade 2 in Jewish society and Grade 3 in Arab, Druze, Bedouin and Circassian society. About fifteen per cent of learners proceed to Stage B through test performance or school recommendation. Admission to gifted programmes is normally set at approximately the 97th national percentile, with a lower threshold for outstanding-student programmes [28].

Development provision is not limited to one institutional form. Ministry information describes full-day weekly gifted centres and after-school frameworks, alongside school-based and national programmes. Content ranges from science, mathematics and technology to humanities research, learning skills and early access to matriculation or academic credit [29]. Earlier scholarship also describes pull-out centres and specialised classes as established elements of the system [30].

The Israeli model's strength is national administrative reach and a common procedure across sectors. Its main design tension lies in the weight given to psychometric thresholds and the relationship between identification and available provision. Critical scholarship reports long-standing concerns about unequal access, programme scale and limited outcome research [31]. These claims are not an official performance assessment; they identify the administrative data that should be linked to service uptake, social-group participation, progression and programme quality.

4.4. Russia: a national resource centre linked to regional systems

The Talent and Success Educational Foundation was established in December 2014, and the Sirius Educational Centre was created on Olympic infrastructure to identify, develop and provide further professional support to children with outstanding achievements in science, arts, sport and technical creativity [32]. Sirius offers intensive programmes, online courses, teacher development and partnership-based routes into research and professional practice.

Regional centres are created by the constituent entities of the Russian Federation, while the Foundation supplies coordination, methods, information environments, teacher development and exchange of practice [33]. Centres identify learners, design programmes and individual routes, build university and employer partnerships, and conduct monitoring research. Official reporting in 2026 referred to 85 centres operating on this model [33].

The case demonstrates a hub-and-network arrangement: a national institution supplies methods, platforms and authority while regions operate services. Its strength is the connection between intensive provision, online reach, educator development and later pathways. Participation records, however, do not establish equity or long-term contribution; comparable regional outcome reporting remains necessary.

4.5. Kazakhstan: presidential mandate and a specialised coordinating centre

Kazakhstan's current architecture grew from Presidential Order No. 3002 of 24 May 1996 on state support and development of schools for gifted children. The order required a specialised-school regulation, a state programme for supporting young talent and measures to preserve and expand educational institutions for gifted learners [34]. The Republican Scientific and Practical Centre "Daryn" was established through Government Resolution No. 256 of 24 March 1998 [35].

Daryn's mission covers the identification, development and professional support of gifted children and talented youth. Its functions include a national information environment, testing programmes and methods, supporting teachers and organisations, and establishing regional resource centres [35]. Olympiads, specialised schools, methodological work and international cooperation remain core instruments.

The case is institutionally relevant to Uzbekistan because a presidential mandate became a permanent specialised organisation and regional infrastructure. It also warns against equating visible competition results with broader development. A coordinating centre still needs evidence on entry, service receipt, progression and differences by region or social background.

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5. Cross-case comparison

Table 1 applies the same analytical dimensions to all five cases. The entries describe formal and publicly visible arrangements; they are not scores. Where official sources did not publish a complete evaluation cycle, the table records the mechanism as partial rather than inferring its existence.

Table 1.

Structured comparison of state-supported systems for high-ability learners

Country	Public mandate and governance	Identification	Development provision	Data, evaluation and feedback	Equity and adaptation	Principal analytical limitation
Singapore	Ministry policy since 1984; central curriculum and identification, with implementation moving toward all-school provision from 2027.	Current two-stage Primary 3 exercise; refreshed process uses one common assessment plus school evidence and repeated entry in Primary 4-5.	Enriched GEP classes until 2028; school-based extensions, after-school programmes and advanced modules at 15 centres from 2027.	Periodic ministerial review and implementation updates; published reform parameters. No participant-level national outcome evaluation identified in the public sources reviewed.	Broader coverage (about 10%); no compulsory school transfer for advanced modules; several identification points.	The reform is being implemented, so its access, quality and outcome effects cannot yet be assessed.
Republic of Korea	Gifted Education Promotion Act; central and city/provincial committees; statutory research institutes and local operating bodies.	Multiple domains; institution-level selection; legal provision for socially or economically disadvantaged learners.	Gifted schools, classes and centres; curriculum flexibility, linkage between levels, teacher training and online provision.	Integrated GED database, learner records, institutional statistics, research functions and national planning capacity.	Special selection measures are authorised for vulnerable groups; regional governance is formalised.	Extensive infrastructure does not by itself demonstrate causal programme effects or equal participation.
Israel	Ministry department and nationally administered procedure rather than a separate comprehensive gifted-education statute.	Two-stage process across official schools; Stage B for about 15%; gifted threshold around the 97th national percentile; recommendations and appeals supplement testing.	Weekly full-day centres, after-school frameworks, school and national programmes, and links to academic credit.	National testing and administrative data are visible; a complete published data-evaluation-policy cycle was not identified.	Common national process across sectors; language, sector and special-condition arrangements exist.	Strong reliance on psychometric thresholds and contested evidence on access, financing and programme reach.
Russia	Talent and Success Foundation and Sirius as a national resource hub; regional centres are established and operated by regions.	Competitive selection through achievements, programme-specific tasks and applications; online routes broaden reach.	Intensive residential programmes, online courses, teacher development, individual routes and university/industry partnerships.	Information platforms, participant records and monitoring expectations for regional centres; public outcome definitions remain uneven.	Network designed for countrywide coverage; programmes are free on a competitive basis; regional capacity varies.	A hub-and-network model complicates attribution and requires comparable regional reporting.
Kazakhstan	Presidential Order No. 3002 (1996), Government Resolution No. 256 (1998), Daryn centre and regional resource structures.	Olympiads, competitions and admission to specialised institutions are prominent routes.	Specialised schools, olympiad preparation, methodological support, teacher and institutional development.	Information and methodological functions are stated; publicly available longitudinal outcome and equity indicators are limited.	Regional centres and social/legal support are included in Daryn's mandate.	Competition outcomes may dominate broader measures of development, participation and transition.

Source: compiled by the author from official and scholarly sources [21-35]. "No complete cycle identified" means that the reviewed public sources did not document all stages from data collection to evaluation and policy adjustment.

5.1. Design proposition 1: durability depends on a public mandate, not on one legal form

The cases do not support the claim that a separate law is necessary in every setting. Korea uses a comprehensive statute; Kazakhstan relies on a presidential order and government resolution; Singapore and Israel have long operated through ministry policy; Russia combines a foundation, presidential support and regional instruments. The shared feature is a durable public mandate that assigns responsibility, authorises expenditure and survives changes in individual programmes. Legal form should therefore be treated as context-dependent. The policy requirement is continuity and enforceable responsibility, not formal uniformity.

5.2. Design proposition 2: systems need a lead authority and an explicit network of responsibilities

None of the cases is governed by one institution acting alone. Even the most centralised arrangements depend on schools, testing bodies, research institutes, universities, regional offices or

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specialised centres. The recurring pattern is a lead authority combined with a defined network. Effective coordination requires clarity over who sets standards, who selects participants, who provides services, who owns data, who evaluates programmes and who acts on findings. A “single coordinating institution” is therefore too narrow; a lead authority with a documented responsibility architecture is the more accurate design principle.

5.3. Design proposition 3: identification and development must form one capacity-managed pipeline

Identification creates no human-capital return unless it is followed by appropriate development. Capacity should be calculated before admissions: number of places, teacher expertise, mentoring hours, geographic access and support for transitions. The Singapore reform illustrates a layered response, with broad school-based provision and smaller advanced modules. Korea’s differentiated institutions serve different levels and domains. Israel shows the administrative strength of national identification but also the need to examine service uptake after status is awarded. Pipeline management should include a suitable route for learners who do not enter the most intensive programme and a re-entry mechanism for late-emerging potential.

5.4. Design proposition 4: a database becomes strategic only when linked to evaluation and decisions

Participant records, application portals and institutional statistics are necessary but insufficient. A data-evaluation-feedback cycle requires five connected elements: stable identifiers, defined indicators, periodic analysis, reporting to authorised decision-makers and a recorded response. Korea’s legal assignment of database and research functions provides the most complete formal architecture among the cases. Other systems show elements of the cycle, but public sources often describe monitoring without specifying outcome measures or decision rules. The management value of data lies in what the system changes after examining them.

5.5. Design proposition 5: adaptation and equity must be built into the operating model

A policy that cannot revise identification, provision or resource allocation will preserve early design errors. Singapore’s current reform is evidence of institutional adaptation after four decades of programme experience. Korea’s law authorises measures for underserved learners. Israel’s sector- and language-specific procedures recognise that a uniform test administration can produce unequal conditions. Russia and Kazakhstan seek regional reach through networks, but regional structures also expose differences in local capacity. Equity should therefore be monitored as a distributional outcome - not assumed from national coverage - and adaptation should occur through scheduled review rather than ad hoc reaction.

6. Implications for Uzbekistan

6.1. The architecture established under Presidential Decree No. PF-86

Decree No. PF-86 establishes three connected directions: a national programme for selected ninth-grade graduates, the Al-Beruniy International School and a community linking talented young people and graduates [11]. The decree also creates a National Council and implementation arrangements that involve several ministries, the Agency for Specialized Educational Institutions, higher education and other public bodies. Public presentation materials describe annual selection of up to 1,500 learners for preparation toward leading foreign universities, specialised advisers and portfolio-building opportunities [36]. The 2026/27 admissions announcement confirms that the national programme has moved from decree to recurring intake [37].

This design has two advantages. First, it connects selection to a defined development offer rather than conferring status alone. Second, it extends the pathway beyond school through international university preparation, specialised schooling and a graduate community. The unresolved management task is to turn these components into one participant journey with shared standards, compatible data and explicit transition rules.

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6.2. Governance: from formal coordination to operating responsibility

The existence of a National Council satisfies the need for high-level mandate, but strategic oversight and daily system ownership are different functions. The implementing architecture should specify one accountable lead for the end-to-end participant pathway and publish a responsibility matrix. At minimum, the matrix should identify responsibility for selection design, appeals, regional access, adviser quality, programme placement, safeguarding, data protection, outcome evaluation, university transition and alumni engagement.

A permanent interagency secretariat could prepare decisions for the National Council, maintain the programme logic model and review implementation data. The scientific-methodological function should be institutionally distinct enough to question programme assumptions, while remaining close enough to administrative data to produce timely analysis. External academic review can strengthen this arrangement at key stages, particularly after the first complete cohort.

6.3. Identification: multiple evidence, repeated entry and capacity-linked admissions

Current selection for the national programme is directed at ninth-grade graduates and uses examination and additional criteria. This creates a clear entry point but should not become the sole national definition of talent. Different domains and developmental stages require different evidence. A national architecture can retain competitive academic selection for programmes that demand it while supporting other routes through teacher nomination, portfolios, research tasks, creative work, olympiad performance and later re-entry.

Admissions numbers should be tied to actual service capacity. Before each cycle, the implementing body should publish the number of adviser places, programme places by region and language, expected mentoring load, criteria for continuation and alternative offers for applicants who meet a threshold but cannot enter the most intensive tier. This prevents the selection gate from expanding faster than the development system.

6.4. Longitudinal data, consent and the evaluation cycle

Uzbekistan needs a longitudinal registry that follows participants across application, selection, programme participation, school completion, higher education and early professional stages. The registry should not be a public ranking system. It requires lawful purpose limitation, role-based access, documented consent or other legal basis, retention rules and protection against the use of early labels as permanent judgments. A participant identifier should link records without exposing unnecessary personal data to every institution.

Evaluation should proceed in stages. The first cycle should test implementation quality: whether selection occurred as designed, whether adviser loads were manageable, whether services were delivered and whether participation differed by region, school type, language, sex or socioeconomic status. The second cycle should examine intermediate outcomes such as retention, portfolio quality, academic progression, wellbeing and university readiness. Long-term evaluation may examine higher-education completion, research or professional contribution, but such outcomes should not be promised before sufficient follow-up time has elapsed.

6.5. Proposed monitoring framework

Table 2 translates the comparative findings into a compact monitoring framework. The indicators should be specified in an implementation manual with definitions, responsible data owners and suppression rules for small groups. Targets should be set only after a baseline year.

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Table 2.

Proposed monitoring framework for the Uzbekistan initiative

Management domain	Core indicator	Disaggregation	Frequency	Decision supported
Reach	Eligible applicants, applicants, selected participants and service recipients; conversion at each stage.	Region, urban/rural location, school type, language, sex, socioeconomic proxy.	Each admissions cycle	Adjust outreach, test access and regional quotas or support.
Capacity	Places available, adviser caseload, contact hours, staff qualifications, programme completion.	Programme, provider, region and language.	Termly	Match admissions to delivery capacity and identify bottlenecks.
Equity	Representation ratios and stage-specific attrition gaps.	Same groups as reach; disability where lawful and feasible.	Each cycle and annually	Review selection instruments, accommodations and support.
Progression	Continuation, re-entry, transition to advanced programmes and higher education.	Cohort, programme and participant group.	Annually	Redesign transition rules and alternative pathways.
Learning and development	Validated academic, research, creative, psychosocial and portfolio measures suited to programme aims.	Programme and baseline level.	Baseline and programme end	Assess programme contribution and improve curriculum.
Long-term outcomes	Higher-education completion, field alignment, research, innovation, public-service or professional contribution.	Cohort and programme; use aggregate reporting.	At 3-, 5- and 10-year intervals	Test the human-capital rationale without overclaiming early returns.
Adaptation	Recommendations issued, decisions taken, implementation status and reasons for non-action.	Responsible institution.	Annual review	Close the feedback loop and create an audit trail for policy learning.

Source: developed by the author from the theoretical framework and cross-case comparison.

6.6. Regional and linguistic access

Foreign models cannot be transferred without reference to Uzbekistan's geography, school distribution and language environment. Participation costs include travel, internet access, test familiarity, adviser availability and the ability of schools to prepare documents or portfolios. A formally national competition may still favour urban schools with stronger information and coaching networks. Regional outreach should therefore be accompanied by diagnostic reporting on application rates, pass rates and service uptake, not by outreach counts alone.

Assessment content, instructions and appeals should be available in the authorised languages of administration, with equivalence checks rather than literal translation alone. Remote preparation can reduce distance but should not replace local mentoring where connectivity is weak. Regional advisers need common standards, supervision and professional development, while retaining enough discretion to respond to local conditions.

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6.7. Alternative and post-programme pathways

A high-stakes pipeline inevitably contains learners who do not advance at a particular stage. The system should specify what follows: school-based enrichment, online advanced modules, referral to specialised programmes, later re-entry or career guidance. An alternative pathway is not a consolation mechanism; it protects earlier investment and recognises that readiness develops at different rates.

The graduate community should also have a defined function. Its value lies in mentoring, research and project networks, internships, knowledge exchange and later contribution to national institutions, not in ceremonial membership. Participation should be voluntary, governed by clear data rules and assessed through substantive engagement rather than membership totals.

7. Discussion

The comparison changes the interpretation of gifted-education policy in three ways. First, the policy object is not the gifted label but the developmental pathway. This follows from Gagné's distinction between natural abilities and developed talents [9] and from the staged account of domain-specific expertise [10]. A system that optimises test administration while leaving development and transition fragmented manages classification rather than talent.

Second, continuity and centralisation are not synonyms. Singapore is distributing provision while retaining ministry standards. Korea combines central and regional committees, several institutional forms and a national database. Russia uses a national resource hub without direct management of every regional centre. The common requirement is an intelligible allocation of responsibility across a network.

Third, monitoring should be understood as a governance process rather than an information technology project. Registries and dashboards can count participants, but strategy requires interpretation and authorised response. The proposed Uzbekistan framework therefore includes an adaptation indicator: recommendations, decisions and implementation status. This records whether the system has learned, not merely whether it has collected data.

The design propositions also qualify the human-capital argument. Long-term economic or social contribution cannot be inferred from olympiad medals, university admissions or programme completion. Those measures may be meaningful intermediate outcomes, but the return claim requires later evidence and attention to costs and distribution. A credible policy can acknowledge this delay while establishing the records and comparison groups needed for future assessment.

8. Limitations and research agenda

The study relies on public documents and published literature. Internal budgets, participant-level records, programme-quality reviews and unpublished evaluations were unavailable. Country data refer to different years, and institutional terms do not always have exact equivalents across languages. The cases were selected for analytical relevance, not statistical representation. The five propositions should therefore be tested in a wider sample and through fieldwork with administrators, educators, participants and families.

Further research in Uzbekistan should begin with a process evaluation of the first cohorts. It should examine how applicants learn about the programme, whether test and additional criteria behave similarly across regions and languages, how adviser support is delivered, which learners decline or leave, and what alternative services they receive. A later quasi-experimental design may compare selected participants with applicants near the threshold, provided that the selection rule, data quality and ethical conditions permit such analysis. Qualitative follow-up is also needed because achievement indicators alone will not capture wellbeing, identity, motivation or institutional fit.

9. Conclusion

Developing the human capital of talented youth requires more than early identification. Human capital theory frames development as an investment whose benefits emerge over time and must be measured with discipline. Developmental theories of giftedness show why potential is domain-sensitive,

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environmentally dependent and open to later emergence. Strategic talent management places the pathway within a network of institutions, differentiated opportunities and transitions.

The five-country comparison supports five provisional design propositions. A durable system needs a stable public mandate; a lead authority with explicit responsibilities across a network; capacity alignment between identification and development; a data-evaluation-feedback cycle; and a scheduled ability to revise policy while monitoring equity. These propositions do not identify a single best national model. They describe management conditions that can be adapted to different legal and institutional settings.

Uzbekistan's PF-86 architecture provides a strong mandate and several connected programme components. Its next stage is institutional integration. A longitudinal registry, capacity-linked admissions, repeated entry routes, distributional indicators, staged evaluation and defined post-programme pathways would allow the initiative to learn from its first cohorts. The central test of the system will not be how many learners it selects, but whether it can convert diverse potential into sustained capability and adjust when the evidence shows that part of the pathway is not working.

Declarations

Conflict of interest and positionality

The author is employed by the Agency for Specialized Educational Institutions and works in the unit responsible for implementing the "President's Talented Children" initiative. No confidential administrative data were used. The analysis and recommendations are the author's scholarly interpretation and do not constitute an official position of the Agency.

Data availability

The study is based on publicly available legal instruments, official institutional materials and published scholarly literature. The principal online sources and access date are provided in the reference list.

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INSTITUTIONAL ARCHITECTURE AND COORDINATION RISKS IN UZBEKISTAN'S SYSTEM FOR DEVELOPING THE HUMAN CAPITAL OF GIFTED YOUTH

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ABSTRACT

Uzbekistan has created a dense set of institutions for identifying gifted pupils, educating them in specialized settings, supporting admission to foreign universities, financing study abroad, and organizing return and employment. The rapid growth of this field has produced substantial capacity, but the legal instruments were adopted at different times and assign related functions to bodies with distinct reporting lines. This article examines the institutional architecture in force on 1 January 2026 through a structured analysis of ten republican legal instruments, comprising eight primary acts and two amending acts. The study separates policy coordination from programme operation, maps responsibilities across six stages of the participant pathway, and records both evidence of linkage and documentary silence. Five coordination risks are identified: overlapping eligibility routes for foreign-study support without an explicit cross-instrument priority rule; incomplete interoperability across participant information systems; uneven allocation of university-application support; removal from a specialized school without a specified developmental follow-up procedure; and the absence of a common outcome framework spanning identification, education, foreign study, return, and employment. Two numerical claims made in an earlier version are corrected. The ratio of 200 foreign-study quotas to the maximum annual National Programme intake of 1,500 is only a nominal ratio and cannot be interpreted as observed coverage. The 14 Chief Advisers coordinate school advisers and cannot be used to calculate the participant-to-adviser caseload. A non-arithmetic prioritization method is therefore used, based on documentary strength, policy consequence, and feasibility of remedy. Comparative reference points from the Republic of Korea, Israel, Kazakhstan, and Singapore are used to identify design options rather than to rank national systems. The article proposes a three-stage reform sequence: legal clarification, data governance and interoperability, and outcome-based management. A revised monitoring framework specifies valid denominators, distinguishes unavailable baselines from zero values, and treats numerical targets as matters for post-baseline policy decision.

ACCEPTED

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Keywords: *institutional analysis; horizontal coordination; gifted youth; talent development; education governance; Uzbekistan.*

1. Introduction

Policies for gifted youth cut across organizational and sectoral boundaries. Identification usually begins during compulsory schooling, while later stages involve advanced instruction, university admission, scholarships, mobility, employment, and long-term professional development. Each stage may be governed by a different body, financed through a different budget, and reported through a separate administrative chain. The quality of the system therefore depends not only on the capacity of individual institutions but also on the rules that connect them.

Uzbekistan has expanded this field rapidly since 2019. Presidential Schools were regulated in 2019; the Youth Affairs Agency received a broad youth-policy coordination mandate in 2020; the network of specialized schools was enlarged in 2022; and 2025 brought the reorganization of the El-yurt umidi Foundation, the launch of the President's Gifted Children initiative, the National Programme for prospective applicants to foreign universities, and the creation of the Al-Beruni International Boarding School. These measures established new selection procedures, forms of academic support, scholarship routes, advisory positions, databases, councils, and commissions [10-19].

Institutional growth does not automatically produce an integrated policy pathway. An applicant may pass through several systems whose rules were written for different purposes. The same organization may act as funder in one process and database operator in another. A body that coordinates policy may be mistaken for a scholarship operator, while a technical centre within an agency may be treated as an independent actor. Such classification errors obscure where responsibility is genuinely assigned and where it remains uncertain.

The research question is: how are responsibilities for gifted-youth development distributed in Uzbekistan's legal framework, and which coordination risks can be demonstrated from the text of the instruments in force on 1 January 2026? Three subsidiary questions follow. First, which bodies coordinate policy and which operate programmes? Second, what formal links connect identification, development, foreign-study support, return, and employment? Third, which proposed reforms can be justified without treating documentary silence as proof of implementation failure?

The contribution is both substantive and methodological. Substantively, the article offers a corrected institutional map and a reform sequence grounded in the legal architecture. Methodologically, it replaces unsupported quantitative assertions with bounded documentary findings. The analysis does not claim that every legal ambiguity produces a failure in practice. It identifies points where implementation evidence is needed and states the conditions under which each finding could be confirmed or rejected.

2. Theoretical framework and related literature

Institutional analysis begins with the distinction between formal rules and actual conduct. North described institutions as the constraints that structure interaction, while Scott separated regulative, normative, and cultural-cognitive elements [1,2]. A legal document is therefore a primary source for the formal allocation of authority, but it cannot by itself establish how consistently that authority is exercised. This distinction is essential in a policy field where administrative practice may compensate for gaps in written rules.

The coordination literature explains why formally competent organizations may still produce fragmented results. Peters linked horizontal coordination problems to organizational interests and the defence of jurisdiction [3]. Hood's account of New Public Management showed how specialization and agency autonomy can sharpen responsibility within organizations while weakening connections between them [4]. Whole-of-government reforms emerged partly as a response to that fragmentation. Christensen and Laegreid emphasized shared goals, information, and accountability, whereas Pollitt warned that structural reorganization often leaves operating processes unchanged [5,6]. Bouckaert, Peters, and Verhoest distinguished hierarchical, market, and network mechanisms and argued that real administrative systems combine them [7].

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Talent management adds a pathway perspective. Collings and Mellahi treated talent systems as differentiated architectures rather than extensions of ordinary personnel administration [8]. Khilji, Tarique, and Schuler located talent development within a wider ecosystem linking education, labour markets, and mobility [9]. For gifted youth, this means that school selection, enriched education, international study, and professional utilization should be examined as connected transitions. A gap at a transition may matter more than a well-designed programme within a single stage.

The present study uses two concepts. An institutional allocation is a formal assignment of a function to a named body. A coordination risk is a documentary condition that may hinder continuity across bodies or stages. It may take one of four forms: overlapping eligibility without a cross-instrument resolution rule; a transfer of responsibility without a specified handover; an information link without an operational exchange protocol; or a system-wide goal without a common outcome measure. These are risks in legal design, not findings of administrative misconduct.

3. Materials and methods

3.1 Research design

The study employs structured qualitative document analysis. Regulatory and organizational documents can serve as an independent empirical source when the question concerns formally stated purposes, powers, procedures, and reporting relationships [20]. Content analysis requires an explicit unit of analysis, a predetermined category scheme, and a record that connects interpretations to source passages [21,22]. The method used here is closer to a doctrinal institutional map than to frequency-based text mining: the analytical weight of a provision depends on the authority and function it establishes, not on the number of times a word appears.

The unit of analysis is a provision, subparagraph, or annex entry that assigns a function, defines eligibility, creates a body or information system, imposes an obligation, or requires interaction with another actor. Each relevant provision was entered in an extraction matrix with the following fields: legal source and version; actor; target group; stage of the pathway; decision power; financing or support mechanism; information or reporting requirement; cross-actor link; and interpretive note. Appendix A reproduces the evidence log used for the principal findings.

3.2 Corpus and version control

The corpus contains ten republican instruments: eight primary acts and two amending acts. Inclusion required a direct connection to the identification, education, foreign-study support, coordination, information management, return, or employment of gifted youth. Consolidated legal texts were read as they stood on 1 January 2026. Where the current LexUZ page displays a later amendment, the amendment was excluded if its effective date fell after the cut-off. For example, the amendment to a PF-86 priority criterion that entered into force on 1 February 2026 was not treated as operative on 1 January 2026. This rule prevents a current webpage from silently changing the historical corpus.

Table 1.

Legal corpus and role in the analysis

Instrument	Date	Status in corpus	Principal relevance
Presidential Decree PF-86	15 May 2025	Primary	President's Gifted Children initiative; National Programme; Al-Beruni School; National Council; Republican Commission; adviser structure; 200 annual quotas from 2027
Presidential Decree PF-77	5 May 2025	Primary	El-yurt umidi Foundation; scholarship routes; selection; scholarship-holder database; return and service obligations
Presidential Decree PF-61	26 March 2025	Primary	Bright Talent project and measures connected with overseas study and return support
Presidential Decree PF-106	14 April 2022	Primary	Expansion and governance of the specialized-school network
Presidential Decree PF-197	29 October 2025	Amending	Management Efficiency Agency role in public-service training and monitoring; amendments affecting El-yurt umidi arrangements

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Instrument	Date	Status in corpus	Principal relevance
Cabinet Resolution No. 526	25 June 2019	Primary	Regulation of Presidential Schools and admissions
Cabinet Resolution No. 233	5 May 2022	Primary	Regulation of specialized schools, educational stages, class size, progression, and removal
Cabinet Resolution No. 550	11 September 2020	Primary	Youth Affairs Agency status and coordination mandate
Cabinet Resolution No. 130	28 February 2025	Amending	Terminological and organizational amendments affecting the school regulations
Cabinet Resolution No. 797	17 December 2025	Amending	Amendments to regulations for creative and specialized schools

3.3 Analytical categories and decision rules

Table 2.

Analytical categories

Code	Question applied to each provision	Use in the analysis
A1 Actor and status	Which body, unit, school, council, commission, or fund is named, and is it independent or subordinate?	Prevents a subordinate service unit from being counted as an independent policy actor.
A2 Population and stage	Which pupils, graduates, candidates, scholarship holders, specialists, or public servants are covered?	Tests whether apparently similar rules apply to the same population.
A3 Function	Does the provision concern identification, development, application support, financing, study abroad, return, employment, information, or oversight?	Maps the participant pathway.
A4 Decision authority	Who selects, approves, funds, supervises, or resolves exceptions?	Separates coordination from operational decision making.
A5 Information and reporting	What database, platform, report, monitoring duty, or exchange requirement is specified?	Identifies continuity and accountability mechanisms.
A6 Cross-actor link	Does the provision require cooperation, integration, approval, referral, or handover?	Distinguishes a formal linkage from parallel activity.
A7 Counterevidence	Does another provision partly close the apparent gap?	Reduces one-sided interpretation and records uncertainty.

A coordination risk was recorded only when the relevant instruments interact at the same transition and no explicit rule in the corpus resolves the issue. The absence of a rule was not treated as proof that administrators have no informal procedure. Each finding is assigned a documentary strength: strong, when the relevant legal boundary and missing procedure are directly visible; moderate, when the finding depends on reading several instruments together; and provisional, when implementation data are essential.

The study was conducted by a single author. No inter-coder reliability coefficient is reported. A second reading was used to check the extraction matrix, but repeated coding by the same researcher cannot substitute for independent coding. Reproducibility is supported instead through exact provision references, explicit decision rules, and the inclusion of counterevidence. Future work should have a second coder review the full matrix and should publish the machine-readable extraction file.

3.4 Scope and limitations

The analysis is confined to formal institutional design. It does not measure how many pupils receive support, whether databases are already connected in practice, how decisions are made in individual cases, or whether graduates meet service obligations. Legal silence may be filled by internal instructions, contracts, or administrative routines outside the selected corpus. The comparative section is illustrative and does not claim causal identification. Finally, the author's institutional position may improve access to terminology and context while also creating a risk of confirmation bias. The positionality statement at the end of the article records this limitation.

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4. Institutional architecture

4.1 School-level identification and specialized education

The Agency for Specialized Educational Institutions is the principal system manager at the school stage. Presidential Schools and specialized schools are educational providers within its system rather than separate national policy actors. Cabinet Resolution No. 526 regulates the Presidential Schools, including admissions, international programmes, and the possibility of international qualifications. Cabinet Resolution No. 233 regulates specialized schools in the exact sciences for grades 5-11 and natural sciences for grades 7-11, with a maximum of 24 pupils per class [14,16]. PF-106 provides the broader policy basis for expanding the network [19].

PF-86 added the Al-Beruni International Boarding School and a National Programme for up to 1,500 grade 9 graduates per year. Programme participants are attached to school advisers during grades 10 and 11, receive additional instruction through a dedicated platform, and may attend short courses aligned with foreign university requirements. The legal ratio of participants to one school adviser is no more than 15. The same decree created 14 Chief Adviser posts to coordinate the work of school advisers across the regions, along with a six-person initiative unit in the Agency's central apparatus [10].

These two adviser categories must not be conflated. School advisers provide direct support and are subject to the 1:15 ratio. Chief Advisers are regional coordinators. Since the corpus does not state the total number of school-adviser posts actually filled, the participant caseload cannot be calculated from the 14 Chief Adviser posts. Any staffing assessment requires payroll and assignment data, not a division of programme participants by regional coordinators.

4.2 Foreign-study support and the El-yurt umidi Foundation

PF-77 reorganized the El-yurt umidi Foundation and gave it a broad mandate: targeted internships, professional orientation, scholarship selection, financing of study abroad, monitoring during study, a scholarship-holder database, and support after return. The Foundation is an operator and funder, not merely a coordinating platform. Its Management Board determines scholarship fields and quotas, while an open competition uses tests and interviews. The decree also requires non-state representation in the competition commission and the recording and online publication of interviews [11].

The return mechanism is formalized through contracts. The required continuous service periods are two years for a targeted internship, five years for a bachelor's degree, three years for a master's degree, and five years for doctoral study. Breach may lead to recovery of twice the Foundation's expenditure. Following the October 2025 amendment, the Management Efficiency Agency coordinates and monitors the creation of conditions for the professional use and career development of returning specialists in the public-service sphere [11,12].

PF-77 also requires a Unified Automated Information System integrated with the Presidential Golden Fund platform. This provision is important because it contradicts a blanket claim that all information resources are legally isolated. The more precise finding is that one bilateral integration requirement exists, while the selected corpus does not establish a field-wide data-governance protocol linking the National Programme, school records, scholarship administration, and post-return employment records.

4.3 Youth-policy coordination

The Youth Affairs Agency has a broad coordination mandate. Cabinet Resolution No. 550 directs it to coordinate work connected with sending gifted young people to leading foreign universities and participation in international competitions, and to support intellectual development. The wording is a coordination function. It does not, in the cited provisions, create a separate scholarship route with its own eligibility conditions, quota, payment rules, or selection operator [18]. It should therefore not be counted as a fifth funding channel alongside El-yurt umidi and PF-86 scholarship mechanisms.

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The distinction matters for governance design. A coordinator may request information, align activities, or monitor implementation without selecting scholarship winners. Treating every broad mandate as an operational channel inflates the number of overlaps and makes the actor map less accurate.

4.4 Strategic and oversight bodies

PF-86 created a National Council and a Republican Commission for the President's Gifted Children initiative. The Council sets strategic direction, while the Commission supports implementation and control. The El-yurt umidi Management Board governs the Foundation's scholarship and financial decisions. The Youth Affairs Agency coordinates youth policy, and the Management Efficiency Agency has responsibilities related to public-service training and career monitoring. These bodies operate at different levels and for partly different populations. The issue is not their number alone, but whether their interfaces, escalation rules, and shared reporting obligations are clear.

Table 3.

Actors classified by governance role

Actor or structure	Governance role	Population or stage	Key legal basis
Agency for Specialized Educational Institutions	System manager and programme operator	School-stage identification, specialized education, National Programme support	PF-86; PF-106; CMR 526; CMR 233
Presidential and specialized schools; Al-Beruni School	Educational providers	Grades 5-11 or programme-specific cohorts	CMR 526; CMR 233; PF-86
School advisers	Direct transition-support providers	National Programme participants in grades 10-11; Al-Beruni pupils under its model	PF-86
Chief Advisers	Regional coordination of school advisers	Fourteen regions	PF-86, paras. 9-10
El-yurt umidi Foundation	Scholarship operator, funder, database operator, return-contract administrator	Applicants, scholarship holders, interns, graduates	PF-77
Youth Affairs Agency	Youth-policy coordinator	Young people generally	CMR 550
National Council and Republican Commission	Strategic direction and oversight	President's Gifted Children initiative	PF-86
Management Efficiency Agency	Public-service training coordination and career monitoring	Public servants and relevant returning specialists	PF-197 amendments; PF-77 as amended

5. Functional analysis of the participant pathway

5.1 Identification and development

The legal framework contains several identification processes, but they are not interchangeable. Entrance examinations for Presidential and specialized schools select pupils for particular educational institutions. The National Programme examination identifies up to 1,500 grade 9 graduates with potential for foreign higher education. El-yurt umidi selection concerns candidates who already meet programme-specific requirements for study abroad. The coexistence of different assessments is not itself a flaw: each serves a different stage and purpose. A coordination question arises only when results or participant records should pass from one stage to another.

Development mechanisms are stronger within defined programmes. Specialized schools provide subject-focused curricula and regulated class sizes. PF-86 adds school advisers, a dedicated platform, short-term study, portfolio support, and foreign-university preparation for National Programme and Al-Beruni participants. The legal design is therefore differentiated rather than uniform. The policy question is whether comparable transition support is available to gifted graduates who fall outside those cohorts.

5.2 University-application support

The earlier formulation of a complete responsibility vacuum between school graduation and admission to a foreign university is too broad. PF-77 assigns the Foundation professional-orientation functions, and PF-86 assigns advisers to National Programme participants. The corpus nevertheless does

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not clearly designate a body responsible for universal, structured application support for all graduates of Presidential, creative, and specialized schools. Scholarship rules generally require evidence of admission, while the most detailed preparation provisions are tied to specific cohorts. The resulting risk is uneven access, not total institutional absence.

This finding is moderate rather than conclusive. It can be tested through graduate surveys, school-adviser staffing records, application-support logs, and interviews with programme operators. Evidence that all relevant graduates receive a defined package of counselling, examination preparation, recommendation support, and application review would weaken or remove the finding.

5.3 Routes for foreign-study support

PF-77 and PF-86 create several operational routes. The Youth Affairs Agency mandate is excluded from this table because it is coordinative. The routes differ by ranking threshold, grant condition, population, and method of selection.

Table 4.

Operational routes for foreign-study support

Route	Eligibility trigger	Population	Selection or award method	Legal basis
PF-77 full-tuition grant route	Admission with full tuition coverage to a top-100 institution	Eligible candidates across degree levels, subject to programme rules	Award without tests within approved quota procedures	PF-77, para. 10(e)(i)
PF-77 limited-cost route	Admission with full tuition coverage to a top-300 institution	Eligible candidates	Support without tests for international travel and living costs	PF-77, para. 10(e)(ii)
PF-77 specialized-school graduate route	Bachelor's admission to a top-20 institution with at least 50% tuition grant	Graduates of Presidential, creative, and specialized schools	Award without tests within quota procedures	PF-77, para. 10(e)(iii)
PF-77 open competition	Admission to an eligible institution, generally within top-300 or an approved specialist list	Bachelor's, master's, and doctoral candidates	Document review, tests, and interview	PF-77 and annexed competition regulation
PF-86 National Programme quota	From 2027, admission to a top-100 institution with at least 50% grant	Al-Beruni graduates and National Programme participants	Up to 200 quotas; internal priority rules if eligible applicants exceed quota	PF-86, para. 8

A candidate may meet the conditions of more than one route. A graduate of a specialized school who also participated in the National Programme and obtained a 50% grant at a top-20 university could fall within both PF-77 and PF-86. Both routes are connected to the El-yurt umidi funding system, which may allow the Foundation to prevent duplicate awards administratively. The selected acts, however, do not state a cross-instrument priority rule for resolving such dual eligibility. The legal risk is inconsistent treatment or delayed case resolution, not a demonstrated instance of double financing.

5.4 Return, service, and professional utilization

Return and service are most developed in the El-yurt umidi system. Contractual service periods, employer duties, monitoring, and financial consequences create a clear accountability chain. The Community established under PF-86 has a different purpose: networking, exchange, and mobilization of intellectual potential. A voluntary community and a contractual service system need not be identical. The coordination issue is whether community participation, scholarship records, and employment outcomes can be linked for system-level analysis while respecting their different legal bases.

5.5 Information and accountability

The legal framework contains several information components: school and admissions records; the National Programme platform; the El-yurt umidi scholarship-holder database; the Unified Automated Information System and its required integration with the Presidential Golden Fund platform; and employment or monitoring records held by employers and public-administration bodies. The existence of these components is a strength. The unresolved question is field-wide interoperability: the corpus does not

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set out a common participant identifier, data dictionary, exchange frequency, lawful-access roles, error-correction process, retention period, or responsibility for producing cross-stage outcome reports.

Departmental accountability is also present. Each actor reports within its own legal structure. What is not clearly identified is a shared outcome framework that follows a cohort from identification through professional utilization. This does not mean that no performance indicators exist anywhere in government. It means that the selected instruments do not provide a common set of cross-agency outcome measures for the gifted-youth pathway.

6. Documented coordination risks

Table 5.

Coordination risks, evidence, and limits of inference

Code	Coordination risk	Documentary evidence	Counterevidence or limitation	Strength
R1	Overlapping eligibility routes lack an explicit cross-instrument priority rule.	PF-77 top-20 route and PF-86 top-100/50% quota can cover the same specialized-school graduate.	The same Foundation is involved in financing and may apply internal controls. No actual duplicate payment is shown.	Moderate
R2	Interoperability is incomplete across the full participant pathway.	Several platforms and databases are created for different stages; no field-wide protocol is specified.	PF-77 requires integration between the Unified Automated Information System and the Presidential Golden Fund platform, so complete isolation is not established.	Strong
R3	Structured university-application support is unevenly allocated.	Detailed adviser support is tied to National Programme and Al-Beruni cohorts; scholarship rules often begin after admission.	PF-77 includes professional orientation, and schools may provide support outside the acts.	Moderate
R4	Removal from a specialized school is not paired with a specified developmental follow-up procedure.	CMR 233, para. 33 lists removal after sustained academic decline despite individual work but does not specify retention of the giftedness record or an alternative plan.	General education transfer occurs in practice; the finding concerns the absence of a specialized follow-up rule in this regulation.	Strong
R5	No common outcome framework spans identification, study, return, and employment.	The instruments assign departmental duties and databases but do not state a unified cohort outcome framework.	Other government reporting instruments outside the corpus may contain relevant indicators.	Moderate

6.1 What the documentary numbers show - and what they do not show

PF-86 sets a maximum annual National Programme intake of 1,500 and, from 2027, up to 200 foreign-study quotas for Al-Beruni graduates and National Programme participants. The arithmetic ratio is 200/1,500, or 13.3%. This figure is not an observed coverage rate. The denominator is a maximum rather than an actual cohort, it excludes Al-Beruni graduates, and eligibility requires qualifying admission and grant conditions. The ratio can be reported only as a nominal comparison between two ceilings stated in the decree.

The adviser figures are similarly limited. PF-86 requires no more than 15 programme participants per school adviser and creates 14 Chief Advisers to coordinate school advisers. It does not state the total number of school advisers. The actual staffing ratio is therefore unavailable from the legal corpus. Dividing 1,500 participants by 14 Chief Advisers compares different roles and produces an invalid caseload estimate.

Zero values also require care. The absence of a clause in the selected corpus is not a measured zero in implementation. For example, "no field-wide data protocol identified" is a documentary finding; it is not equivalent to "zero data exchange." Baselines for trajectory continuity, application support, and employment should be marked unavailable until administrative records are examined.

6.2 Prioritization without an artificial index

An arithmetic mean of ordinal scores can create a false appearance of precision. The revised prioritization uses three separate judgments: documentary strength, policy consequence if the risk materializes, and feasibility of remedy. No weighted index is calculated. The categories guide sequencing rather than claim statistical measurement.

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Table 6.

Qualitative priority matrix

Risk	Documentary strength	Potential policy consequence	Likely remedy	Priority
R4 Specialized-school exit follow-up	Strong	Loss of continuity for a previously identified pupil	Agency regulation or amendment to school regulation; standard exit plan and record retention	Immediate
R1 Dual eligibility across scholarship routes	Moderate	Unequal treatment, delay, or duplicate commitment	Joint rule of the Foundation and Agency; amendment or unified award regulation	Immediate
R3 Uneven application support	Moderate	Access may depend on school or family resources	Define minimum service package and responsible provider; collect baseline data	Near term
R2 Field-wide interoperability	Strong	Trajectory cannot be reliably reconstructed or evaluated	Cabinet-level data-governance decision, technical standards, privacy controls, phased integration	Strategic
R5 Common outcome framework	Moderate	Departmental optimization may obscure pathway outcomes	Shared indicator charter and reporting cycle after data integration	Strategic

7. Comparative reference points

The international material is used to identify design options, not to score countries. The cases differ in population, legal tradition, educational structure, and the relationship between school-level gifted education and overseas scholarships. Each comparison is therefore limited to a specific institutional feature.

Table 7.

Selected international design features

Jurisdiction	Verified design feature	Relevance to Uzbekistan	Caution
Republic of Korea	A dedicated statute assigns national and local policy responsibilities, establishes promotion committees and research institutes, and provides for integrated gifted-education databases.	Shows how data governance and institutional linkage can be stated in primary legislation.	The Korean framework concerns gifted education broadly and does not replicate Uzbekistan's scholarship and return system.
Israel	The Ministry of Education operates a national identification process with staged testing and recognizes later identification of pupils whose abilities emerge at different times.	Supports a developmental approach and the possibility of re-entry or later identification rather than a single irreversible selection point.	Implementation is embedded in Israel's own school system and should not be copied mechanically.
Kazakhstan	The Daryn Centre acts as a system link for identifying and supporting gifted children; the Bolashak scholarship separately regulates return and work obligations.	Shows that school-level talent support and overseas scholarship governance may remain institutionally distinct if their interfaces are explicit.	The two systems serve different populations and legal purposes.
Singapore	The centralized Gifted Education Programme is being replaced from 2027 by broader school-based provisions and centre-based advanced modules, with repeated identification opportunities.	Illustrates periodic redesign to widen access while retaining specialist provision.	The reform was announced after the Uzbekistan corpus cut-off and is used only as a later comparative reference point.

Three lessons follow. First, data integration requires an assigned operator and a legal purpose; a general instruction to cooperate is insufficient. Second, identification systems should accommodate developmental variability and preserve the possibility of later support. Third, scholarship return obligations and school-level gifted education can remain separate, but participant handovers and outcome reporting must be designed deliberately.

8. Reform model

The reform sequence should follow institutional dependencies. Legal ambiguity should be reduced before databases are connected, because digitizing inconsistent rules merely reproduces the inconsistency. Outcome reporting should follow data integration, because cross-stage indicators cannot be calculated reliably from incompatible departmental records.

8.1 Stage I: legal clarification and service continuity (0-12 months)

The first stage requires four measures. A cross-instrument priority rule should resolve dual eligibility under PF-77 and PF-86 before a financial commitment is made. The Agency and Foundation

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should define a minimum university-application support package and specify which graduates are entitled to it. The specialized-school regulation should require a documented transition plan when a pupil is removed for academic reasons. Finally, the National Council should approve a short coordination charter that distinguishes strategic, operational, financial, and monitoring decisions and identifies the escalation route for unresolved inter-agency cases.

8.2 Stage II: data governance and interoperability (6-24 months)

Technical integration should begin with governance rules. A Cabinet-level decision should designate a data operator or a federated governance arrangement, define the lawful purposes of data use, assign access rights, establish a common participant identifier, and approve a minimum data set. The protocol should cover correction of inaccurate records, consent or other lawful grounds where required, retention periods, cybersecurity, audit logs, and procedures for linking school, scholarship, and employment records. A pilot can begin with National Programme participants and El-yurt umidi scholarship holders before expansion to the wider specialized-school system.

8.3 Stage III: outcome-based management (18-36 months)

Once reliable linkage is possible, the National Council should approve a shared outcome framework. Departmental indicators should remain in place, but a small set of pathway indicators should be reported jointly. The purpose is not to rank bodies against one another. It is to show where participants leave the pathway, which groups receive support, how long transitions take, and whether overseas education contributes to employment in relevant sectors.

Table 8.

Implementation roadmap

Measure	Lead and partners	Instrument	Timing	Output
Cross-instrument priority rule for dual scholarship eligibility	El-yurt umidi Foundation; Agency; Ministry of Economy and Finance	Unified award rule or amendments to PF-77/PF-86 implementation regulations	0-6 months	One documented route and financing decision per candidate
Minimum application-support service and coverage rule	Agency; schools; Foundation	Cabinet or ministerial regulation with service standard	0-12 months	Defined support package, eligible population, provider, and record
Specialized-school transition plan after removal	Agency	Amendment to CMR 233 or agency regulation	0-6 months	Retained record, family consultation, referral, and follow-up date
Coordination charter for councils, commission, Foundation, Youth Affairs Agency, and Management Efficiency Agency	National Council	Approved inter-agency regulation	0-12 months	Decision hierarchy, meeting cycle, escalation, and reporting duties
Common identifier and data-exchange protocol	Designated data operator; Agency; Foundation; relevant digital and youth-policy bodies	Cabinet resolution and technical standard	6-24 months	Pilot interoperable participant record
Shared outcome framework	National Council; methodological support from the Agency's research and assessment capacity	Joint indicator charter	18-36 months	Annual pathway report with disaggregated results

9. Monitoring framework

The monitoring framework corrects three recurring measurement errors: an unavailable baseline is not zero; an eligibility ratio is not an outcome rate; and overlapping eligibility is not itself a failure. Indicators should be disaggregated by sex, region, school type, socioeconomic status where lawful and available, disability status where appropriate, and programme route. Numerical targets should be set only after a baseline study, except where the desired standard is legal compliance, such as zero duplicate financing.

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Table 9.

Revised monitoring indicators

No.	Indicator	Formula or decision rule	Data source	Baseline treatment	Interpretation
1	Identification reach	Unique pupils recorded in at least one eligible identification process / clearly defined eligible population x 100	Integrated or linked administrative records; population data	Calculate after denominator and deduplication rules are approved	Measures reach, not giftedness prevalence.
2	Trajectory continuity	Participants with linked records at all required transition points / participants due to make those transitions x 100	Linked participant record	Unavailable until linkage pilot	A missing record is distinguished from an unsuccessful transition.
3	Resolution of multiple eligibility	Cases with more than one eligible route resolved before award / all multiple-eligibility cases x 100; duplicate financing incidents reported separately	Foundation award system and PF-86 quota records	Begin once common matching rule is active	Target for resolved cases should be 100%; target for duplicate financing is zero.
4	Application-support coverage	Graduates receiving the defined minimum support package / graduates eligible for that package x 100	School and adviser logs	Baseline survey and records audit required	Denominator must match the legal entitlement.
5	School-adviser staffing compliance	Participants assigned to each actual school adviser; share of advisers at or below 15 participants	Staffing and assignment records	Cannot be calculated from Chief Adviser posts	Tests compliance with the legal ratio.
6	Continuity after specialized-school removal	Removed pupils with documented transition plan and follow-up / pupils removed for academic reasons x 100	School records and receiving-school confirmation	Collect after procedure is introduced	Measures continuity, not reversal of the removal decision.
7	Return and relevant employment	Graduates employed or engaged in an approved relevant activity within 12 months / graduates due to return x 100	Foundation, employer, and public-administration records	Define approved activity and exceptions before calculation	Should be reported by scholarship route and degree level.
8	Long-term pathway yield	Cohort members in defined high-skill or priority-sector roles at year N+k / original identified cohort x 100	Longitudinal linked data	First result depends on cohort year and chosen k	A long-term indicator; not suitable for annual attribution to one body.

10. Discussion

The revised analysis changes the interpretation of the institutional field in several ways. First, the problem is not a simple absence of coordination. The legal framework already contains high-level councils, coordinating mandates, a scholarship database, an integration requirement, contractual return obligations, and a regional adviser structure. The central issue is the uneven specificity of the interfaces. Some transitions are governed by detailed rules; others rely on broad cooperation clauses or programme-specific arrangements.

Second, multiple routes should not be equated with fragmentation. Differentiated routes may be justified by degree level, university ranking, grant size, policy priority, or target population. The governance risk appears when one person qualifies under more than one route and the system lacks a transparent rule for choosing the applicable route. A unified regulation need not abolish differentiated support. It should make the relationship among the routes intelligible.

Third, the field should be evaluated through continuity rather than institutional volume. The number of schools, scholarships, platforms, councils, or posts does not show whether a participant can move from identification to professional contribution without avoidable loss of information or support. The proposed indicators therefore focus on handovers, assignment, resolution, and follow-up. They also avoid interpreting missing data as poor performance before the reporting system exists.

Fourth, the exclusion rule in specialized schools raises a design question rather than a claim that academic standards should be abandoned. Specialized schools require progression rules, and sustained underperformance may justify transfer. The missing element is a developmental handover: the record of earlier identification, the support already provided, the reason for transfer, and an alternative plan should not disappear when institutional enrolment ends. The Israeli emphasis on later identification and developmental variability provides a useful reference point, but the recommended procedure rests primarily on continuity and administrative fairness.

Fifth, the return-and-service mechanism is one of the strongest parts of the system. The reform agenda should preserve it while improving the connection between scholarship records, employers, career monitoring, and the broader talent community. A common outcome framework would allow decision

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makers to examine not only contractual compliance but also the quality of professional placement and the contribution of trained specialists over time.

The proposed sequence is deliberately conservative. It does not call for a new super-agency. The existing National Council can set common rules; the Agency and Foundation can retain their operational mandates; the Youth Affairs Agency can continue policy coordination; and the Management Efficiency Agency can perform its public-service functions. Integration can be achieved through clear interfaces, data governance, and shared outcomes without erasing institutional specialization.

11. Conclusion

Uzbekistan's legal framework for gifted-youth development contains substantial institutional capacity. Specialized schools, Presidential Schools, the Al-Beruni School, the National Programme, El-yurt umidi scholarships, return obligations, advisory structures, and high-level coordinating bodies cover most stages of the pathway. The framework is neither empty nor wholly fragmented.

Five coordination risks remain visible at the documentary level. Eligibility under PF-77 and PF-86 may overlap without an explicit cross-instrument priority rule. Data integration is partly mandated but does not yet amount to a field-wide governance protocol. Detailed application support is concentrated in specific cohorts. Removal from a specialized school is not paired with a defined developmental follow-up procedure. Departmental accountability is not supplemented by a common pathway outcome framework.

The evidence must be interpreted within limits. The 13.3% figure is a ratio between two legal ceilings, not an observed coverage rate. The 14 Chief Advisers are coordinators and cannot serve as the denominator for the 1:15 school-adviser ratio. Documentary silence does not establish zero implementation. These corrections narrow the claims but strengthen their credibility.

A workable reform path consists of legal clarification, data governance, and outcome-based management. The immediate tasks are a dual-eligibility rule, a minimum application-support standard, and a transition plan for pupils leaving specialized schools. Interoperability should follow through a common identifier and a legally defined data protocol. Shared outcome reporting should be introduced only after reliable linkage is possible. Empirical research should then test the documentary risks using candidate records, staffing data, process tracing, graduate surveys, and employment outcomes.

Declarations

Positionality and conflict of interest

The author is employed by the Agency for Specialized Educational Institutions and works in the unit implementing the President's Gifted Children initiative. The analysis is based on publicly available legal instruments, and the interpretations are the author's own. Institutional familiarity may assist interpretation of administrative terminology but may also create confirmation bias. To reduce that risk, the article distinguishes legal evidence from implementation claims, records counterevidence, and avoids reporting unsupported performance estimates.

Ethics statement

The study uses public legal and policy documents and does not involve human participants or personal data. Ethics committee approval was not required for the documentary analysis.

Data availability

The legal sources are publicly available through the official LexUZ database and the institutional websites listed in the references. The clause-level evidence log supporting the principal findings is reproduced in Appendix A. A machine-readable coding file should accompany any journal submission that requires open research materials.

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Appendix A. Clause-level evidence log for principal findings

The table records the provisions relied on for the institutional map and risk findings. It is not a substitute for a full machine-readable coding file, but it allows readers to trace the main interpretations to legal text.

Table A1.

Evidence log

Source and provision	Extracted rule or function	Analytical use
PF-86, paras. 2-4	Creates the initiative, Community, National Council, and implementation arrangements.	Strategic and coordinating architecture.
PF-86, para. 5	Establishes the Al-Beruni School, adviser and teacher ratios, portfolio support, and institutional autonomy.	School-level development model.
PF-86, para. 6	Selects up to 1,500 grade 9 graduates annually; assigns participants to school advisers at a maximum 1:15 ratio; provides platform-based and short-course support.	National Programme pathway and adviser distinction.
PF-86, para. 8	Provides up to 200 annual foreign-study quotas from 2027 for Al-Beruni graduates and National Programme participants meeting admission and grant conditions.	Nominal 200/1,500 ratio and overlap with PF-77 routes.
PF-86, paras. 9-10	Creates 14 Chief Adviser posts to coordinate school advisers and a six-person initiative unit.	Chief Advisers are coordinators, not direct caseload advisers.
PF-86, para. 12	Creates the Republican Commission for implementation and control.	Oversight architecture.
PF-77, para. 2 and Foundation regulation	Assigns targeted internships, professional orientation, scholarship-holder database, return support, and related functions.	Foundation role extends beyond post-admission financing.
PF-77, para. 10(e)(i)-(iii)	Creates no-test routes based on top-100 full tuition grants, top-300 full tuition grants with limited costs, and top-20 partial grants for specified school graduates.	Operational foreign-study routes.
PF-77, competition regulation	Provides open competition, document review, tests, interviews, and quota allocation.	Separate operational route; transparency rules.
PF-77, para. 13	Sets service periods, employer responsibilities, Management Efficiency Agency monitoring, and double reimbursement for breach.	Return and professional-utilization mechanism.
PF-77 implementation measure on information system	Requires a Unified Automated Information System integrated with the Presidential Golden Fund platform.	Counterevidence to complete database isolation; basis for partial interoperability finding.
CMR 550, Regulation, youth-policy functions	Coordinates work connected with sending gifted youth to leading foreign universities and supports intellectual development.	Classified as coordination, not a scholarship channel.

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Source and provision	Extracted rule or function	Analytical use
CMR 233, paras. 28-31	Defines grades, class size, curriculum, and progression in specialized schools.	School-stage development framework.
CMR 233, para. 33	Allows removal after sustained decline in ranking and academic performance despite individual work, including two consecutive quarters at grade 3 in specialist subjects.	Basis for the specialized-school exit continuity finding.
PF-197 amendments and PF-77 as amended	Assigns Management Efficiency Agency functions in public-service training and monitoring of career use.	Clarifies the sixth governance role without treating it as a school-stage actor.
Korean Gifted Education Promotion Act	Provides statutory coordination bodies, research institutes, linkages across school levels, and integrated gifted-education databases.	Comparative data-governance reference point.
Israel Ministry of Education guidance	National staged identification and recognition of later identification or developmental variation.	Comparative reference for re-entry and developmental continuity.
Daryn and Bolashak official sources	Separate school-level gifted-support centre and overseas scholarship return obligations.	Comparative reference for explicit interfaces between distinct systems.
Singapore MOE 2026 reform	Transition from the existing GEP to wider school-based and centre-based provisions with repeated identification opportunities.	Later comparative reference for periodic redesign and broader access.

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THE MFMR-S QUESTIONNAIRE FOR EVALUATING INDEPENDENT LEARNING ASSIGNMENTS IN A CREDIT-MODULAR SYSTEM: A METHODOLOGICAL EXAMPLE BASED ON SIMULATED DATA

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ABSTRACT
The quality of independent-learning assignments in a credit-modular system cannot be judged from the final product alone; it also depends on the alignment of goal clarity, learning activity, process monitoring, and reflection. This methodological paper presents a preliminary 25-item MFMR-S questionnaire comprising four process dimensions and a separate perceived-effectiveness criterion. The items were derived from constructive alignment, self-regulated learning, formative assessment, and authentic-task literature. To verify scoring and reporting procedures, a fully reproducible synthetic dataset of 50 cases was generated with the fixed random seed 20260805. In the worked example, subscale Cronbach's alpha ranged from 0.771 to 0.861 and one-factor omega from 0.778 to 0.862. Spearman correlations between the process scales and perceived effectiveness ranged from 0.441 to 0.540; the multiple regression model yielded R^2=0.503. These values are not evidence about any student population. They demonstrate coding, diagnostics, and reporting only. MFMR-S should therefore be regarded as a draft instrument rather than a validated scale. Empirical use requires content review, cognitive interviewing, exploratory and confirmatory factor analyses, test–retest assessment, and criterion validation against external learning outcomes.

ACCEPTED

07.08.26

Keywords: *credit-modular system, independent learning, MFMR-S, questionnaire development, simulation, reliability, validation, feedback.*

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1. Introduction

A credit represents the total amount of work expected of a student to achieve specified outcomes, rather than the number of classroom contact hours in the educational process. The ECTS Users' Guide states that credits should be planned in conjunction with learning outcomes and student workload [2]. The Concept for the Development of Higher Education in Uzbekistan until 2030 likewise identifies the preparation of independently minded specialists with contemporary competencies as one of the system's priorities [1]. An independent assignment should therefore not be treated as a discrete task appended to a course syllabus; it should integrate the intended outcome, learning activity, assessment evidence, and feedback into a single didactic unit.

Constructive alignment requires a coherent relationship among the intended goal, the work performed by the student, and the assessment criteria [3]. The revised version of Bloom's taxonomy helps

move tasks beyond remembering and understanding toward analysis, evaluation, and creation [4]. Models of self-regulated learning conceptualize planning, process monitoring, strategy adjustment, and final self-evaluation as interconnected stages [5, 6, 8]. Formative feedback serves the learning process only when it indicates the learner's next course of action [7, 13, 15].

Short questionnaires designed to evaluate independent learning frequently combine assignment design, student self-regulation, and achieved outcomes within a single scale. Such a mixture may produce high internal consistency, yet it leaves unclear which pedagogical mechanism is being measured. Moreover, predictor and outcome measures obtained from the same respondent, through the same response format, and at the same time point may amplify common method variance [20].

The MFMR-S project is intended to separate these two problems. The acronym MFMR is retained from the source-language labels for four process domains: Goal, Activity, Monitoring, and Reflection. The letter "S" is likewise retained from the source-language label for perceived Effectiveness, which is measured as a separate criterion rather than as an additional process component. The purpose of this article is not to announce a finished, validated scale. Rather, it is to translate theoretical constructs into items, specify reverse-coding and scoring procedures precisely, demonstrate a reproducible analytical sequence using synthetic data, and define a validation program for an empirical study.

2. THEORETICAL BOUNDARIES OF THE MFMR-S MODEL

2.1. Alignment between the Goal and the Learning Outcome

The Goal scale addresses why an assignment is given, which knowledge or skill it is intended to develop, what product is expected, and the criteria by which the work will be assessed. This domain is the practical expression of constructive alignment: the activity performed by the student should provide evidence of the intended learning outcome [3].

2.2. Activity and Assignment Design

The Activity scale was designed to assess whether the task is linked to practical situations, organized in stages, requires higher-order thinking, avoids reliance on copying, and is commensurate with the credit workload. Research on authentic assessment indicates that tasks resembling real professional situations strengthen opportunities to apply and transfer knowledge [14]. In experiential learning, the activity itself, the observations derived from it, and subsequent experimentation are likewise inseparable [16].

2.3. Monitoring and Feedback

Monitoring is not limited to checking the final product. Interim checkpoints, a comprehensible rubric, comments directed toward error correction, and early support for students who are falling behind make the process manageable. The effect of feedback depends more on its specificity, timing, and connection to the next step than on its volume [7, 13, 15].

2.4. Reflection and the Self-Regulation Cycle

The Reflection domain treats planning, self-checking during performance, managing procrastination, adjusting strategy in response to feedback, and drawing conclusions at the end of the work as a single provisional cycle. In the models of Zimmerman and Pintrich, these actions correspond to the phases of forethought, performance control, and final self-evaluation [5, 6]. The models reviewed by Panadero likewise interpret reflection as a mechanism that modifies subsequent activity [8]. The assumption that these five items form a single factor is theoretical and must be tested through factor analysis using empirical data.

2.5. Effectiveness as a Separate Criterion

The Effectiveness scale measures not the assignment process but the student's perception of the learning outcome: deeper understanding of the content, analytical thinking, preparation for professional tasks, perceived influence on learning, and application of knowledge in a subsequent situation. An earlier item concerning self-regulation was removed from the outcome scale because it overlapped conceptually

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with the Reflection domain. Nevertheless, perceived effectiveness cannot replace an external criterion such as an actual grade, a rubric score, or on-time completion of the assignment.

Table 1.

Operational Map of the MFMR-S Constructs

Construct	Operational content	Items	Theoretical basis and source
Goal	Clarity of the assignment purpose, expected evidence, and assessment criteria	1–5	Constructive alignment [3]
Activity	Practical relevance, sequencing, cognitive demand, and workload alignment	6–10	Bloom's taxonomy; authentic and experiential learning [4, 14, 16]
Monitoring	Interim checks, process monitoring, feedback, and rubric	11–15	Formative assessment and feedback [7, 13, 15]
Reflection	Planning, self-monitoring, revision, and final review	16–20	Self-regulated learning [5, 6, 8]
Effectiveness	Perceived understanding, transfer, and professional preparedness	21–25	Separate outcome criterion [9–12]

3. MATERIALS AND METHODS

3.1. Type of Study and Unit of Analysis

This study represents the preliminary stage of methodological instrument development. No human participants were involved. The unit of analysis was a set of 50 computer-generated synthetic response records. Terms such as "respondent," "student opinion," or "sample result" are not used to describe the synthetic calculations. The numerical outputs demonstrate only how scoring, reliability coefficients, correlations, regression, and diagnostic tables can be produced.

3.2. Item Development and Instrument Status

The initial items were developed deductively from theoretical sources. Five statements were selected for each construct. Responses are recorded on a Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). To assess automatic acquiescence tendencies, Items 4, 9, 14, 18, and 24 were worded in the reverse direction. Reverse-worded statements may, however, generate a separate method factor; their comprehensibility must therefore be examined in cognitive interviews. The present version is an author-developed draft that has not undergone expert content validation and does not have the status of an applied diagnostic instrument. Scale development should evaluate construct definition, expert appraisal, cognitive testing with the target group, item reduction, factor structure, reliability, and validity as distinct stages [17, 18].

3.3. Generation of Synthetic Data

The reproducible example was generated using the NumPy random-number generator with the seed fixed at 20260805. Four multivariate normally distributed latent variables were first generated for Goal, Activity, Monitoring, and Reflection. Their prespecified correlation matrix is presented in Table 2. The latent Effectiveness variable was constructed as $0.22 \cdot \text{Goal} + 0.38 \cdot \text{Activity} + 0.42 \cdot \text{Monitoring} + 0.30 \cdot \text{Reflection} + 0.62 \cdot \varepsilon$. For each item, a loading between 0.65 and 0.82, item-specific random error, and thresholds of −1.15, −0.35, 0.35, and 1.10 separating five response categories were applied. Reverse-worded statements were transformed in the raw file using $6-x$. The complete code is provided in Appendix 3.

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Table 2.

Simulation Correlation Matrix for the Four Process Latent Variables

Variable	Goal	Activity	Monitoring	Reflection
Goal	1.00	0.30	0.25	0.25
Activity	0.30	1.00	0.45	0.35
Monitoring	0.25	0.45	1.00	0.40
Reflection	0.25	0.35	0.40	1.00

SHA-256 checksum of the synthetic raw-data CSV file:
fcb71261ceb959fb30ef1afc0bdc52bf2b6d5e1f0c0a25817307e0e9cbd7a22b
This value can be used to verify that re-running the code produces an identical file.

3.4. Coding and Scale Scores

Reverse-worded items were recoded using the formula 6−x. Each subscale score was calculated as the arithmetic mean of its five corresponding items. The synthetic file contains no missing responses. In an empirical study, a prespecified protocol would calculate a subscale mean only when at least four items had been answered; otherwise, the value would be coded as missing. The ranges 1.00–1.80, 1.81–2.60, 2.61–3.40, 3.41–4.20, and 4.21–5.00 are provided solely for descriptive convenience and are not normative cut-offs.

3.5. Statistical Analysis

Descriptive analyses reported the mean, standard deviation, and proportion of responses scored 4 or 5. Internal consistency was expressed using Cronbach's alpha and McDonald's omega derived from a one-factor model. A percentile-bootstrap 95% confidence interval for alpha was calculated from 2,000 resamples. Because alpha depends on restrictive assumptions such as tau-equivalence, it should not be interpreted as the sole source of reliability evidence [19].

Monotonic associations between the process scales and Effectiveness were summarized using Spearman's rho, with 95% bootstrap confidence intervals. In an ordinary least-squares regression in which all four process scores were entered simultaneously as predictors of Effectiveness, the reported statistics were B, standard error, standardized beta, 95% confidence interval, t, p, and VIF. The residual distribution was assessed with the Shapiro–Wilk test; variance stability with the Breusch–Pagan test; linearity with the Ramsey RESET test; autocorrelation with the Durbin–Watson statistic; and influential observations with Cook's distance. P values were retained to display the complete statistical software output; in synthetic data, they do not constitute evidence about a real population.

3.6. Ethical Considerations and Research Integrity

Because no human participants, personal data, or actual academic outcomes were used, participant consent and ethics committee approval were not required for this methodological example. Before empirical testing begins, the relevant ethical approval will be obtained; the voluntary nature of participation will be explained in writing; students will be assured that refusal will not affect their grades; and directly identifying information will be stored separately from scale responses. The author expressly acknowledges the obligation not to present the synthetic results as empirical data.

4. RESULTS OF THE SYNTHETIC WORKED EXAMPLE

The following statistics are products of the data-generation rules described in Section 3.3. They reflect the selected simulation parameters and one random realization of 50 records, rather than the instrument's actual psychometric properties.

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Table 3.

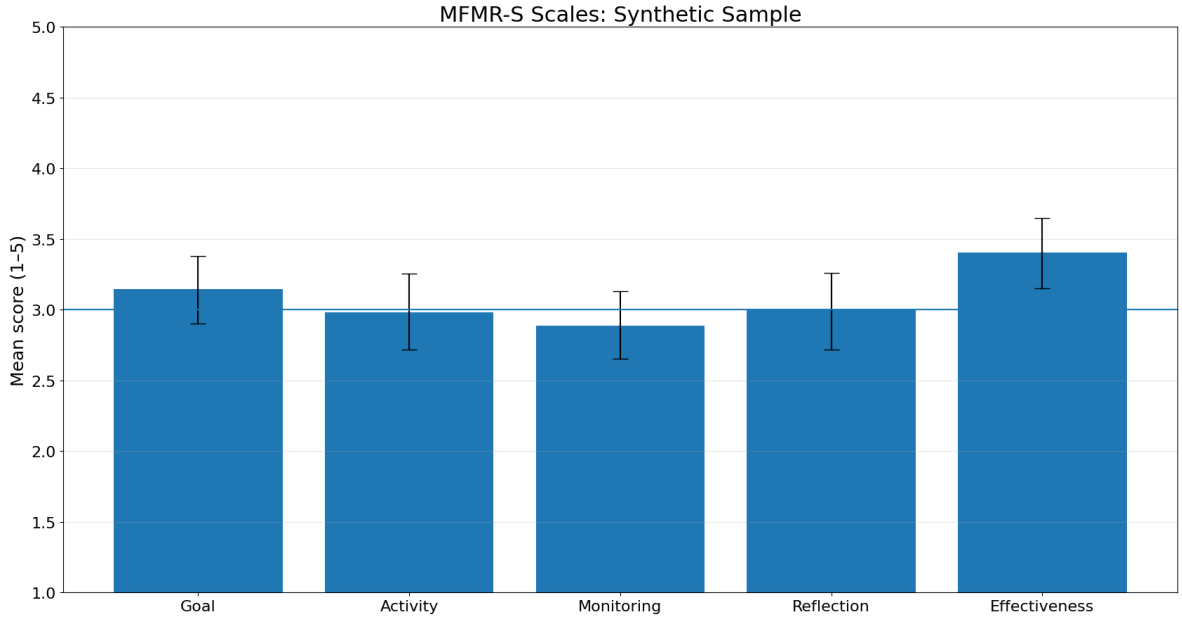
Synthetic Descriptive and Internal-Consistency Statistics for the MFMR-S Subscales (n=50)

Scale	α [95% CI]	ω	M (SD)	4–5, %
Goal	0.771 [0.640; 0.853]	0.778	3.14 (0.85)	39.2
Activity	0.861 [0.774; 0.908]	0.862	2.98 (0.99)	34.0
Monitoring	0.794 [0.651; 0.868]	0.797	2.89 (0.89)	33.6
Reflection	0.851 [0.771; 0.898]	0.854	3.00 (0.99)	38.0
Effectiveness	0.840 [0.746; 0.895]	0.844	3.40 (0.89)	45.2

In the worked example, alpha ranged from 0.771 to 0.861 and omega from 0.778 to 0.862. The proximity of the alpha and omega estimates indicates no marked divergence under the one-factor calculation; however, this pattern does not constitute validity evidence in synthetic data whose factor structure has not been tested. The highest mean was observed for Effectiveness (M=3.40), and the lowest for Monitoring (M=2.89). Because this ordering was shaped in advance through the item thresholds and latent formula, no inference is made about an educational setting.

Figure 1.

Mean MFMR-S Scale Scores and 95% Bootstrap Confidence Intervals



At the item level, the lowest mean was recorded for Q11 (M=2.62), followed by Q10 (M=2.82) and Q12 (M=2.84). The highest values were observed for Q21 (M=3.58), Q23 (M=3.48), and Q25 (M=3.44). Corrected item–total correlations ranged from 0.417 to 0.762. These values do not justify decisions about item retention; with empirical data, polychoric correlations, factor loadings, item information, and content coverage should be considered jointly. The complete item table is provided in Appendix 4.

Table 4.

Spearman Associations between the Process Scales and Effectiveness

Process scale	ρ [bootstrap 95% CI]	p*
Goal	0.540 [0.272; 0.734]	<0.001
Activity	0.441 [0.187; 0.650]	0.001
Monitoring	0.448 [0.169; 0.647]	0.001
Reflection	0.513 [0.257; 0.706]	<0.001

** p values display the output for the synthetic data and are not used for inference to a real population.*

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All four coefficients were positive and ranged from 0.441 to 0.540. The larger coefficients for Goal and Reflection are specific to this particular simulation realization. Although the latent Effectiveness formula assigned larger coefficients to Monitoring and Activity, the same ordering need not emerge in 50 discretized response records. This discrepancy illustrates why, in simulation studies, a data-generating parameter must not be treated as identical to the coefficient estimated in a sample.

Table 5.

Multiple Regression Predicting Effectiveness: Synthetic Worked Example

Predictor	B (SE)	β	95% CI	t; p*; VIF
Goal	0.210 (0.139)	0.199	[-0.070; 0.490]	t=1.51; p=0.139; VIF=1.57
Activity	0.222 (0.107)	0.246	[0.006; 0.437]	t=2.07; p=0.044; VIF=1.28
Monitoring	0.288 (0.113)	0.285	[0.059; 0.516]	t=2.54; p=0.015; VIF=1.15
Reflection	0.268 (0.111)	0.296	[0.044; 0.491]	t=2.42; p=0.020; VIF=1.36

Model output: R^2=0.503, bootstrap 95% CI [0.346; 0.697], adjusted R^2=0.459, F(4,45)=11.41, p<0.001. Among the standardized coefficients, Reflection (β=0.296) and Monitoring (β=0.285) were larger. The regression interval for Goal included zero; in this synthetic example, this finding demonstrates that a bivariate correlation and a coefficient from a multivariable model do not have the same interpretation.

Table 6.

Regression Diagnostics

Diagnostic domain	Statistic	Result	Interpretation for the synthetic sample
Residual normality	Shapiro–Wilk	W=0.981; p=0.581	No clear departure was detected
Variance stability	Breusch–Pagan	LM=2.59; p=0.629	No indication of heteroscedasticity was observed
Linearity	Ramsey RESET	F=0.17; p=0.686	No requirement for a quadratic specification was indicated
Residual autocorrelation	Durbin–Watson	DW=1.95	The value is close to 2
Influential case	Cook's distance	max D=0.152	Less than 1
Multicollinearity	VIF	1.15–1.57	No serious problem was apparent

5. DISCUSSION

The worked example demonstrates the complete MFMR-S data-processing sequence: recoding reverse-worded items, calculating subscale scores, evaluating internal consistency with two coefficients, distinguishing the relationship between process and outcome, and examining regression assumptions. Nevertheless, none of the calculated coefficients confirms that the instrument is reliable or valid among actual students. The high alpha values are a natural consequence of having specified the simulated item loadings around a single factor in advance. Alpha alone guarantees neither unidimensionality nor adequate content coverage [19].

Separating MFMR from Effectiveness improves construct clarity. The process scales represent instructor-managed assignment characteristics and students' process strategies, whereas Effectiveness represents a perceived outcome. Nevertheless, common method variance remains when all domains are measured in the same questionnaire, at the same time, and with the same response scale [20]. In an empirical study, assignment design could be assessed using an instructor or independent-expert rubric,

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monitoring could be derived from learning management system logs, reflection could be obtained from student responses, and the outcome could be represented by a grade or a standardized assignment indicator.

The composition of the Reflection scale requires separate examination. Although planning, procrastination, self-monitoring, use of feedback, and final review theoretically belong to one cycle, empirical data may separate them into two or three factors, such as forethought, performance control, and reflection. Factor analysis should therefore be planned not merely to "confirm a five-factor model," but to compare the fit of competing models.

Furthermore, the 50-record sample was not designed to evaluate factor structure. The sample size required for structural models varies substantially according to the number of indicators, factor loadings, number of factors, missing data, and model complexity; a fixed rule specifying a certain number of respondents per item is insufficient [21]. Monte Carlo planning should be used for empirical validation. As a practical initial benchmark, an EFA sample of approximately 200–300 cases may be considered for 25 items [17], but the final sample size should be justified through simulation-based analyses of power and precision.

6. VALIDATION PROGRAM USING EMPIRICAL DATA

Transforming MFMR-S into a publishable measurement instrument requires a sequential, preregistered protocol. A favorable result at one stage does not replace the subsequent stage.

Table 7.

Recommended Validation Stages for MFMR-S

Stage	Participant/source	Primary assessment	Decision criterion
1. Content review	5–7 experts in pedagogy, psychometrics, and credit-modular education	Item–construct alignment, comprehensibility, redundant and missing content	CVI/CVR; revision based on expert comments
2. Cognitive interviews	10–15 students from the target group, in 2–3 rounds	Interpretation of the question, response-selection process, and reverse-worded items	Rewrite or remove ambiguous items
3. Pilot administration	A small group drawn from different years and fields of study	Completion time, missing responses, and floor/ceiling effects	Correct administrative problems
4. EFA and item reduction	Sample size justified by Monte Carlo analysis; practical initial range of 200–300	Polychoric correlations, parallel analysis, and oblique rotation	Evaluate loadings, cross-loadings, content, and reliability jointly
5. Independent CFA	A sample separate from that used for EFA	Fit of five-factor, four-factor, and competing models	CFI/TLI, RMSEA, SRMR, residuals, and theoretical interpretation
6. Reliability	CFA samples and a retest subgroup	Omega, alpha, test–retest reliability, and measurement error	95% intervals and item diagnostics
7. Validity	External grade, rubric, submission status, or standardized test	Convergent, discriminant, and criterion-related validity	Prespecified hypotheses
8. Invariance	Adequately sized groups by sex, year of study, field, or mode of instruction	Configural, metric, and scalar invariance	Test before conducting between-group comparisons

The empirical protocol should be openly preregistered, with exclusion criteria, procedures for handling missing data, and primary and supplementary analyses specified in advance. When scale scores are compared across courses or semesters, mean comparisons should not be made before measurement invariance has been established. Rather than measuring the outcome solely through student self-report, at least one external indicator of learning should be included.

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7. THE MFMR MAP FOR ASSIGNMENT DESIGN

Until the questionnaire has been validated, the MFMR logic may still be used as a quality-control checklist. In this use, no score is assigned and no diagnosis is made about a student. For each independent assignment, the instructor prepares written answers to five questions: What learning outcome is intended? Through which product will the student demonstrate that outcome? In what stages will the work be completed? When and how will feedback be provided? How will the student analyze the process? This map can be used to check the scope of the assignment against the credit workload, identify interim support points before final grading, and redesign tasks that are susceptible to copying.

Table 8.

Concise MFMR Map for an Independent Assignment

Domain	Quality-control questions
Goal	Is the learning outcome expressed with a precise verb? Are the assessment criteria aligned with the outcome?
Activity	Does the task require student analysis or decision-making? Is its scope appropriate for the time allocated?
Monitoring	Are interim submission points and feedback deadlines specified? Is the rubric provided in advance?
Reflection	Does the student evaluate the plan, errors, strategy, and next steps in writing?
Evidence of effectiveness	What actual product or outcome, beyond perceived benefit, will be obtained?

8. LIMITATIONS

First, all numerical results are synthetic. They do not describe the circumstances of any university, course, subject, or group of students.

Second, the items have not yet undergone expert review or cognitive interviewing with the target group. No conclusion can be drawn regarding content or face validity.

Third, omega was obtained from a one-factor calculation that approximated the data as continuous. For empirical Likert data, polychoric correlations and an ordinal model may be preferable.

Fourth, OLS regression was applied to scale means for 50 synthetic cases. This step demonstrates software output and does not validate the model.

Fifth, Effectiveness is also a self-report measure. Unless it is linked to independent assessment evidence in subsequent research, common method bias will remain.

9. CONCLUSION

MFMR-S is a preliminary questionnaire designed to characterize an independent learning assignment through four process domains—Goal, Activity, Monitoring, and Reflection—and a separate Effectiveness criterion. The reproducible 50-record synthetic example demonstrated the technical format for coding, subscale calculation, internal consistency, correlation, regression, and diagnostic reporting. The numerical results are not empirical evidence and must not be used to make judgments about educational practice. The instrument’s scientific status can be established only after content review, cognitive testing, factor validation, reliability assessment, measurement-invariance testing, and examination of associations with external learning outcomes using real participants.

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APPENDIX 1. PRELIMINARY MFMR-S QUESTIONNAIRE

Instructions. The following statements are preliminary items designed to evaluate how independent learning assignments are organized. The instrument has not been validated; ethical approval and the respondent's informed consent are required before it is used for research purposes. Response options: 1 - strongly disagree; 2 - disagree; 3 - neither agree nor disagree; 4 - agree; 5 - strongly agree. Respondents are not asked to provide their full name, telephone number, or any other directly identifying information.

I. Clarity of the Goal

#	Statement	1	2	3	4	5
1	The purpose of each independent learning assignment is clearly explained to me.	1	2	3	4	5
2	The knowledge, skill, or competency that the assignment is intended to develop is specified.	1	2	3	4	5
3	The performance requirements and expected outcome are communicated before the assignment is given.	1	2	3	4	5
4	What is expected of me in independent assignments is often unclear.	1	2	3	4	5
5	The assignment and its assessment criteria are aligned with the course learning outcomes.	1	2	3	4	5

II. Activity and Assignment Design

#	Statement	1	2	3	4	5
6	The assignments encourage me to apply theoretical knowledge in practical situations.	1	2	3	4	5
7	Independent assignments are structured progressively, from simple to complex.	1	2	3	4	5
8	The tasks require analysis, the use of evidence, and independent decision-making.	1	2	3	4	5
9	Independent assignments are largely limited to copying ready-made information.	1	2	3	4	5
10	The scope of the assignment is commensurate with the time allocated and the credit workload.	1	2	3	4	5

III. Monitoring and Feedback

#	Statement	1	2	3	4	5
11	For major assignments, interim stages and checkpoint dates are specified.	1	2	3	4	5
12	The instructor monitors not only the final outcome of the assignment but also the process of completing it.	1	2	3	4	5
13	Feedback on completed work is provided in a timely manner.	1	2	3	4	5
14	When I make an error, I do not receive sufficient guidance on how to correct it.	1	2	3	4	5
15	The assessment rubric or criteria are provided in advance and are clear to me.	1	2	3	4	5

IV. Reflection and the Self-Regulation Cycle

#	Statement	1	2	3	4	5
16	Before starting an assignment, I prepare a sequence of steps and a time plan.	1	2	3	4	5

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#	Statement	1	2	3	4	5
17	During the work, I monitor how closely I am following my plan and check my progress.	1	2	3	4	5
18	I often postpone independent assignments until the deadline.	1	2	3	4	5
19	After receiving feedback from the instructor, I reconsider my working method or solution strategy.	1	2	3	4	5
20	At the end of an assignment, I write down what I learned, where I made mistakes, and what I would change next time.	1	2	3	4	5

V. Perceived Effectiveness - Separate Criterion

#	Statement	1	2	3	4	5
21	Independent assignments help me understand the course content more deeply.	1	2	3	4	5
22	Independent learning develops my analytical and critical thinking skills.	1	2	3	4	5
23	The assignments improve my preparedness for future professional tasks.	1	2	3	4	5
24	Independent assignments do not have a substantial effect on my learning outcomes.	1	2	3	4	5
25	I can apply the knowledge acquired through an independent assignment to a subsequent topic or a new situation.	1	2	3	4	5

APPENDIX 2. CODING AND SCORING KEY

Positively keyed items retain their original values. Reverse-worded Items 4, 9, 14, 18, and 24 are recoded using the formula 6−x: 1→5, 2→4, 3→3, 4→2, and 5→1. The mean of the five items is then calculated for each subscale.

Subscale	Items	Formula
Goal	1–5	(Q1+Q2+Q3+Q4R+Q5)/5
Activity	6–10	(Q6+Q7+Q8+Q9R+Q10)/5
Monitoring	11–15	(Q11+Q12+Q13+Q14R+Q15)/5
Reflection	16–20	(Q16+Q17+Q18R+Q19+Q20)/5
Effectiveness	21–25	(Q21+Q22+Q23+Q24R+Q25)/5

Descriptive ranges: 1.00–1.80 - very low; 1.81–2.60 - low; 2.61–3.40 - moderate; 3.41–4.20 - high; 4.21–5.00 - very high. These ranges are not normative. Once empirical data have been collected, they should be reconsidered in light of the distribution, percentiles, measurement error, and the practical consequences of decisions.

APPENDIX 3. CODE FOR REPRODUCING THE SYNTHETIC DATA

The following Python code reproduces the 50×25 raw Likert-response file exactly. NumPy and pandas are required. The expected SHA-256 value for the resulting CSV file is provided in Section 3.3 of the document.

```
import numpy as np
import pandas as pd

seed = 20260805
rng = np.random.default_rng(seed)
n = 50
corr4 = np.array([
 [1.00, .30, .25, .25],
 [.30, 1.00, .45, .35],
 [.25, .45, 1.00, .40],
 [.25, .35, .40, 1.00]])
Z = rng.normal(size=(n, 4)) @ np.linalg.cholesky(corr4).T
G, A, M, R = Z.T
S = .22*G + .38*A + .42*M + .30*R + .62*rng.normal(size=n)
F = np.column_stack([G, A, M, R, S])
F = (F - F.mean(0)) / F.std(0)
```


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```
loads = {
 'G':[.78,.76,.72,.68,.74], 'A':[.77,.73,.79,.66,.70],
 'M':[.80,.75,.78,.67,.74], 'R':[.74,.77,.65,.72,.79],
 'S':[.82,.78,.74,.67,.76]}
shift = {'G':.10, 'A':.00, 'M':.05, 'R':.02, 'S':.35}
item_shift = {
 'G':[.05,.00,-.05,-.10,.05], 'A':[.05,-.05,.00,-.15,-.20],
 'M':[-.25,-.05,.05,-.10,.05], 'R':[.00,-.15,-.10,.05,.00],
 'S':[.25,.10,.10,-.05,.05]}
cut = np.array([-1.15, -.35, .35, 1.10])
D, q = {}, 1
for fi, key in enumerate(['G','A','M','R','S']):
    for j, lam in enumerate(loads[key]):
        e = rng.normal(size=n)
        y = lam*F[:,fi] + np.sqrt(1-lam**2)*e + shift[key] + item_shift[key][j]
        D[f'Q{q}'] = np.digitize(y, cut) + 1
        q += 1
D = pd.DataFrame(D)
for q in [4, 9, 14, 18, 24]:
    D[f'Q{q}'] = 6 - D[f'Q{q}']
D.to_csv('mfmr_synthetic_seed_20260805.csv', index=False)
```

APPENDIX 4. ITEM-LEVEL SYNTHETIC DIAGNOSTICS

Item	Scale	M (SD)	4–5, %; corrected item–total r
Q1	Goal	3.36 (1.21)	48.0%; 0.647
Q2	Goal	2.98 (1.17)	30.0%; 0.617
Q3	Goal	3.12 (1.14)	40.0%; 0.503
Q4	Goal	3.14 (1.11)	38.0%; 0.542
Q5	Goal	3.12 (1.24)	40.0%; 0.417
Q6	Activity	3.24 (1.27)	48.0%; 0.746
Q7	Activity	2.90 (1.16)	28.0%; 0.616
Q8	Activity	3.00 (1.31)	32.0%; 0.762
Q9	Activity	2.96 (1.21)	30.0%; 0.657
Q10	Activity	2.82 (1.22)	32.0%; 0.612
Q11	Monitoring	2.62 (1.23)	26.0%; 0.618
Q12	Monitoring	2.84 (1.17)	28.0%; 0.660
Q13	Monitoring	3.06 (1.24)	42.0%; 0.594
Q14	Monitoring	3.00 (1.21)	36.0%; 0.454
Q15	Monitoring	2.92 (1.14)	36.0%; 0.552
Q16	Reflection	3.00 (1.29)	38.0%; 0.717
Q17	Reflection	3.00 (1.25)	38.0%; 0.721
Q18	Reflection	2.88 (1.26)	36.0%; 0.510
Q19	Reflection	3.12 (1.19)	40.0%; 0.710
Q20	Reflection	2.98 (1.27)	38.0%; 0.660
Q21	Effectiveness	3.58 (1.20)	48.0%; 0.650
Q22	Effectiveness	3.36 (1.24)	46.0%; 0.558
Q23	Effectiveness	3.48 (1.05)	46.0%; 0.683
Q24	Effectiveness	3.16 (1.20)	42.0%; 0.694
Q25	Effectiveness	3.44 (1.01)	44.0%; 0.652

Note: Reverse-worded items were recoded before the item diagnostics were calculated. The table pertains to the synthetic example and must not be used to make empirical decisions about retaining or removing an item.

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PROBLEM-SOLVING COMPETENCY AS A DIMENSION OF CREATIVE COMPETENCY AMONG PRE-SERVICE TECHNOLOGY TEACHERS IN UZBEKISTAN: A DESCRIPTIVE SURVEY

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ABSTRACT
Creative competency is increasingly emphasized in teacher preparation and includes several related dimensions. This study examined problem-solving competency as one dimension of creative competency among pre-service technology teachers in Uzbekistan. A quantitative descriptive design was used with 130 participants purposively recruited from three higher education institutions: the National Pedagogical University of Uzbekistan named after Nizami, Termez State Pedagogical Institute, and Bukhara State University. Data were collected through a 15-item online, scenario-based assessment that underwent expert content review. Percentage scores were summarized using three descriptive bands defined for this study: low (0%-40%), medium (41%-70%), and high (71%-100%). Half of the participants were classified in the medium band (n = 65, 50.0%), 32 were in the low band (24.6%), and 33 were in the high band (25.4%). The distribution shows substantial variation in problem-solving performance across the sample. Because the score bands were not externally validated and no reliability coefficient is reported, the results should be interpreted descriptively rather than diagnostically. Design Thinking is discussed as a pedagogical framework that may inform future intervention research; it was not tested in this study. The findings provide a baseline for further instrument validation and research on problem-solving development in technology teacher education in Uzbekistan.

ACCEPTED

10.08.26

Keywords: *creative competency, problem solving, pre-service teachers, technology education, Design Thinking, Uzbekistan.*

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Introduction

Rapid technological change has expanded the professional demands placed on teachers who prepare learners to work with tools, systems, design processes, and emerging technologies. International competency frameworks increasingly position creativity, critical thinking, and problem solving as important learning outcomes rather than optional enrichment. The Partnership for 21st Century Learning framework identifies creativity and innovation together with critical thinking and problem solving among core learning and innovation skills (Battelle for Kids, 2019). Similarly, the OECD Learning Compass 2030 includes creativity and problem solving among the competencies needed to navigate unfamiliar contexts and shape future outcomes (OECD, 2019). UNESCO's ICT Competency Framework for Teachers also

emphasizes the role of teacher development in enabling learners to become collaborative, creative problem solvers in technology-rich educational environments (UNESCO, 2018).

Creativity itself is commonly understood as involving both originality and effectiveness or appropriateness (Runco & Jaeger, 2012). In professional teaching, however, creativity is broader than idea generation alone. It can involve recognizing ill-structured problems, reframing constraints, generating alternatives, selecting workable solutions, and adapting those solutions to learners and contexts. For technology teachers, these processes are particularly relevant because classroom tasks frequently combine pedagogical, technical, material, and design constraints.

Uzbekistan has continued to reform its education system within a contemporary legal framework established by the 2020 Law on Education (Republic of Uzbekistan, 2020). Within this context, evidence about the competencies of future teachers can help teacher educators identify areas in which curricula and practical training may need strengthening. Empirical work focused specifically on the creative and problem-solving competencies of pre-service technology teachers in Uzbekistan remains limited relative to the broader international literature. The present study contributes descriptive evidence from three higher education institutions.

Creative Competency and Problem-Solving

Creative competency is best treated as a multidimensional construct rather than a single score that can be fully represented by one skill. The standard definition of creativity emphasizes the production of outcomes that are both original and effective (Runco & Jaeger, 2012), while broader educational frameworks connect creativity with critical thinking, collaboration, reflection, and problem solving (Battelle for Kids, 2019; OECD, 2019). Accordingly, a measure focused on problem solving can provide information about an important component of creative performance, but it should not be interpreted as a comprehensive measure of creativity.

Problem solving is especially relevant to technology teacher preparation because technology education involves identifying needs, working within constraints, testing alternatives, and refining solutions. These processes overlap with creative thinking when problems are open ended and permit multiple plausible pathways. Research with pre-service teachers in other contexts has likewise shown uneven performance on tasks that require flexible or varied solutions. For example, Ubah and Ogbonnaya (2021) found that many pre-service primary teachers had difficulty generating varied solutions to pattern-based problem-solving tasks. Although their context and assessment differed from the present study, their findings illustrate the importance of examining problem-solving processes directly rather than assuming that teacher candidates automatically acquire them through disciplinary coursework.

Accordingly, this study focuses specifically on problem-solving competency as one dimension of creative competency. The assessment does not represent the full construct of creativity, and the descriptive design does not support causal explanations for participants' performance.

Design Thinking as a Pedagogical Implication

Design Thinking has attracted interest in education because it organizes problem solving around iterative, human-centered processes such as understanding needs, defining problems, generating ideas, prototyping, testing, and revising. Razzouk and Shute (2012) described Design Thinking as an analytic and creative process involving experimentation, model creation, feedback, and redesign. Henriksen et al. (2017) further argued that Design Thinking can help educators approach complex problems of practice that do not have simple linear solutions.

Research reviews support the relevance of Design Thinking to educational settings while also showing that its implementation varies substantially. Cook and Bush (2018) described Design Thinking as a useful approach for integrated STEAM learning, and Li and Zhan's (2022) systematic review of K-12 Design Thinking-integrated learning identified its use in developing a range of twenty-first-century competencies. More recently, Alvarado (2025) reviewed Design Thinking as an active methodology in

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higher education and reported recurring associations with creativity, problem solving, critical thinking, active participation, and interdisciplinary collaboration.

On this basis, Design Thinking is considered a relevant pedagogical framework for future work in technology teacher education. The current study did not implement an intervention, so no conclusions are drawn about its effectiveness. Its role here is to inform pedagogical interpretation and identify a direction for subsequent experimental or quasi-experimental research.

Study Purpose and Research Question

The purpose of this study was to describe the distribution of problem-solving competency scores among pre-service technology teachers in Uzbekistan using the study assessment and aggregate score distribution. The following research question guided the analysis:

How are problem-solving competency scores distributed across low, medium, and high descriptive bands among the participating pre-service technology teachers?

Method

Research Design

A quantitative descriptive, cross-sectional design was used to characterize the distribution of problem-solving scores among the participating pre-service technology teachers. The study did not test causal relationships or intervention effects, making a descriptive design appropriate to the research question (Creswell & Creswell, 2018).

Participants and Sampling

The sample consisted of 130 pre-service technology teachers enrolled at three higher education institutions in Uzbekistan: the National Pedagogical University of Uzbekistan named after Nizami, Termez State Pedagogical Institute, and Bukhara State University. Participants were selected through purposive sampling from technology teacher education programs. The use of three institutions broadened the geographical and institutional coverage of the study, but purposive sampling does not support claims of national representativeness. The present analysis treats the 130 participants as one aggregate sample and does not make institution-level comparisons.

Instrument

Data were collected using a 15-item online assessment administered through Google Forms. The items presented pedagogical problem scenarios and required participants to identify or formulate an appropriate solution. The assessment was developed for the study with reference to competency-oriented teacher education and international frameworks that emphasize creativity and problem solving. Content was reviewed by the research supervisor and subject-matter specialists in pedagogical sciences before administration.

Total performance was converted to a percentage score. Scores were then classified into three descriptive bands defined for this study: low (0%-40%), medium (41%-70%), and high (71%-100%). These categories were used to summarize the observed score distribution and were not treated as externally validated diagnostic cut scores. A reliability coefficient and detailed item-level psychometric statistics are not reported. Accordingly, the assessment is interpreted as a locally developed descriptive measure rather than a fully validated scale.

Procedure and Ethical Considerations

The online assessment was distributed to participants through their academic departments. Participation was voluntary, and participants were informed that the data were being collected for academic research purposes. Responses were collected anonymously, and no personally identifying information was reported in the study dataset. Data collection was conducted across the three participating institutions using the same online format.

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Data Analysis

Frequencies and percentages were used to summarize the distribution of participants across the three descriptive score bands. To indicate sampling uncertainty around each proportion, 95% Wilson confidence intervals were calculated from the observed counts. The analysis was conducted for the sample as a whole; institution-level and demographic inferential analyses were not performed.

Results

The distribution of the 130 participants is presented in Table 1. The largest group was the medium band, which contained exactly half of the sample (n = 65, 50.0%). The low and high bands were nearly equal in size: 32 participants (24.6%) were classified in the low band, and 33 participants (25.4%) were classified in the high band.

Table 1

Distribution of Problem-Solving Competency Scores (N = 130)

Score band	Score range	n	%	95% CI
Low	0%-40%	32	24.6	18.0%-32.7%
Medium	41%-70%	65	50.0	41.5%-58.5%
High	71%-100%	33	25.4	18.7%-33.5%
Total	-	130	100.0	-

Note. Confidence intervals are Wilson 95% confidence intervals for proportions. The score bands were defined for descriptive analysis in this study and do not represent externally validated diagnostic thresholds.

The 95% confidence interval for the medium-band proportion ranged from 41.5% to 58.5%. The corresponding intervals were 18.0% to 32.7% for the low band and 18.7% to 33.5% for the high band. The near-equal low- and high-band proportions show variation in performance across the sample. Because no external proficiency benchmark was used, these categories describe the score distribution and should not be interpreted as pass/fail or competence/incompetence classifications.

Discussion

Interpretation of the Findings

Problem-solving performance was distributed across all three descriptive bands, with the medium band containing the largest share of participants. Exactly half of the sample fell in the medium band, while the remaining half was almost evenly divided between the low and high bands. This pattern indicates substantial variation in problem-solving performance rather than concentration in a single performance band.

This finding is relevant to teacher education because problem solving is one component of the broader set of competencies associated with creativity and future-oriented learning (Battelle for Kids, 2019; OECD, 2019). The assessment focused on problem-solving scenarios; therefore, the findings refer specifically to this dimension and do not represent participants' overall creative competency. Other dimensions, including originality, flexibility, divergent production, creative self-efficacy, collaboration, and the quality of implemented products, were not measured separately.

The uneven distribution is broadly compatible with research showing that pre-service teachers can vary substantially in their ability to generate or apply flexible solutions. Ubah and Ogbonnaya (2021), for example, reported difficulty among a substantial portion of pre-service teachers when tasks required varied creative solutions. Direct numerical comparison is not appropriate because the participants, tasks, and scoring systems differ, but both studies point to the value of making creative problem solving an explicit object of assessment and instruction.

Implications for Technology Teacher Education

The findings suggest that technology teacher education programs could provide more systematic opportunities for candidates to practice ill-structured problem solving, generate multiple alternatives,

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justify design choices, test prototypes, receive feedback, and revise solutions. Such experiences would align with the broader emphasis on creativity and problem solving in international competency frameworks (OECD, 2019; UNESCO, 2018).

Design Thinking is one possible framework for organizing such experiences. Its iterative movement among understanding users, defining problems, ideating, prototyping, testing, and revising is conceptually aligned with the types of open-ended problem solving required in technology and STEAM education (Cook & Bush, 2018; Razzouk & Shute, 2012). Reviews of Design Thinking in K-12 and higher education also report recurring links with creativity, problem solving, collaboration, and active learning (Alvarado, 2025; Li & Zhan, 2022).

The study did not test whether Design Thinking improves problem-solving scores. Future research could develop a validated competency measure and evaluate a structured Design Thinking intervention using a pretest-posttest design, preferably with a comparison group. Such a study could examine not only total scores but also specific components such as problem identification, idea fluency, solution originality, feasibility, iteration, and reflection.

Limitations and Future Research

This study has several limitations. First, purposive sampling from three institutions limits generalizability to the national population of pre-service technology teachers. Including participants from multiple institutions broadens coverage but does not make the sample statistically representative of Uzbekistan.

Second, the instrument assessed problem solving rather than the full multidimensional construct of creative competency. Its reliability and item-level psychometric properties require further evaluation, and the low, medium, and high cut points have not been externally validated. The score bands therefore function only as descriptive categories. Future research should pilot the instrument, document the response format and scoring rubric in detail, quantify content validity, report internal-consistency or inter-rater reliability as appropriate, and examine construct validity.

Third, the analysis was limited to aggregate frequency data. It did not examine institution-level sample sizes, demographic characteristics, item-level patterns, means, standard deviations, or raw-score distributions. Future studies should retain and analyze these data so that subgroup variation, item difficulty, and the specific types of problem-solving tasks that are most challenging can be evaluated.

Finally, the cross-sectional descriptive design cannot identify causes of participants' performance or establish the effectiveness of Design Thinking. Longitudinal, experimental, or quasi-experimental studies are needed before causal claims about pedagogical interventions can be made. The ethical procedures described in this study include voluntary participation and anonymous reporting, but formal ethics approval or exemption status is not documented. Future research should record this status explicitly in accordance with institutional and journal requirements.

Conclusion

This study provides a descriptive baseline of problem-solving competency, treated as one dimension of creative competency, among 130 pre-service technology teachers from three higher education institutions in Uzbekistan. Half of the participants fell within the medium score band defined for this analysis, while approximately one quarter fell in each of the low and high bands. The distribution demonstrates substantial variation in performance but should not be interpreted as a national estimate or as evidence against an external proficiency standard.

Overall, the findings describe variation in problem-solving performance rather than overall creative competency. Design Thinking offers a relevant direction for future research but requires direct evaluation using validated measures and stronger research designs. Future studies should strengthen sampling, retain item-level data, and establish psychometric validity.

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FORMATION OF COOPERATION SKILLS IN PRESCHOOL CHILDREN: A THEORETICAL, METHODOLOGICAL, AND PRACTICE-ORIENTED FRAMEWORK

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ABSTRACT
Cooperation is a foundational competence of early childhood because it integrates communication, shared goal formation, perspective-taking, emotional regulation, and coordinated action. This article develops a theoretically grounded and methodologically explicit framework for forming and assessing cooperation skills in preschool children. The paper is based on a critical synthesis of DOI-verified research on shared intentionality, peer interaction, cooperative problem solving, social-emotional competence, play-based pedagogy, classroom quality, and recent collaborative interventions. Rather than claiming completed experimental outcomes, it specifies a feasible quasi-experimental design for children aged five to six, including paired and small-group productive tasks, an observation rubric, reliability procedures, and an ethical analysis plan. The synthesis indicates that effective cooperation is most likely when children work toward a visible common product, depend on one another's roles, have time to negotiate, and receive calibrated rather than directive adult support. A five-domain observation framework is proposed: shared goal maintenance, role coordination, communication and negotiation, mutual assistance, and constructive conflict resolution. The article concludes that cooperation should be treated as an intentionally taught, observed, and progressively scaffolded competence within preschool curricula.

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Keywords: *preschool education, cooperation skills, peer interaction, shared intentionality, collaborative problem solving, guided play, social-emotional competence, observation rubric, joint activity, school readiness.*

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1. Introduction

Preschool education is not limited to the transmission of elementary knowledge. It is also a social environment in which children learn how to enter a group, sustain a common activity, express their intentions, understand the intentions of others, wait, help, negotiate, and repair interaction after disagreement. These forms of participation are often summarized under the broad term cooperation. In educational practice, however, cooperation is sometimes treated as if it emerged automatically whenever several children are placed at one table. Developmental research suggests a more demanding interpretation: productive cooperation requires a shared goal, coordinated roles, mutual responsiveness, and a willingness to regulate individual action in relation to the actions of a partner [1–6].

The preschool period is especially significant because children's peer interactions become more stable and complex while language, perspective-taking, emotional understanding, and self-regulation are developing rapidly. Early cooperation is therefore both an outcome of development and a context that can stimulate development. When children build a structure together, create a shared drawing, dramatize a story, solve a practical problem, or organize a role-play scenario, they must make their ideas public and compare them with those of others. They may discover that an individual plan cannot be completed without another child's action. They also encounter disagreement in a relatively safe setting and can learn that conflict does not have to terminate joint activity.

A central pedagogical problem is that the quality of joint activity varies widely. Some groups divide the materials but continue to work independently. Others follow the most dominant child without genuine negotiation. In still other groups, children create a common plan, allocate roles, monitor one another's contributions, and revise the product through discussion. All three situations may appear to an observer as children 'working together,' yet they reflect very different levels of cooperation. For this reason, preschool pedagogy needs operational criteria that distinguish physical proximity from coordinated collaboration.

The original version of this paper drew on several regional textbooks and program descriptions whose bibliographic details could not be confirmed reliably through DOI or authoritative publisher records. In the present revision, unverified and bibliographically incomplete items have been removed from the evidence base. The theoretical and methodological argument is rebuilt around fifteen traceable scholarly sources, each linked to a verified DOI. The purpose is not merely to increase the number of references but to strengthen the relationship between the claims made in the paper and the evidence cited.

The study has three objectives. First, it synthesizes developmental and educational research explaining how cooperation emerges and why it matters during the preschool years. Second, it identifies pedagogical conditions that can transform ordinary group activity into genuine collaborative learning. Third, it presents a concrete research design and observation framework that may be used in a future empirical study of five- to six-year-old children. The article is therefore a theoretical and methodological contribution rather than a report of completed experimental results.

2. Theoretical Framework

2.1. Cooperation as shared intentionality

A useful starting point is the concept of shared intentionality. Tomasello and colleagues describe human cooperation as the ability to participate in activities organized around a joint goal, complementary roles, shared attention, and mutual knowledge that the participants are acting together [1]. This formulation is important for preschool pedagogy because it clarifies that cooperation is not simply prosocial behavior. A child may be kind or helpful without participating in a sustained joint plan, and two children may pursue the same activity without understanding it as a shared project. Cooperation becomes structurally visible when participants orient to a common outcome and regulate their contributions in relation to one another.

Developmental evidence shows that the foundations of coordinated action appear early but become more sophisticated over time. Brownell and Carriger found developmental changes in cooperation and self-other differentiation during the second year of life [2]. By the preschool years, children can coordinate complementary roles, recruit a partner, monitor whether the partner is participating, and react when collaboration breaks down. Warneken, Chen, and Tomasello demonstrated that young children can engage in cooperative activities requiring interdependent action [6]. Hamann and colleagues further showed that collaboration influences how young children distribute jointly obtained rewards, suggesting that cooperative effort is linked to emerging expectations of fairness [10].

These findings imply that preschool cooperation should be understood as a multidimensional competence. It includes cognitive elements, such as representing the goal and anticipating steps; communicative elements, such as explaining, requesting, and confirming; social-cognitive elements, such as recognizing a partner's role and viewpoint; and motivational elements, such as remaining committed to

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the shared task. A narrow assessment that counts only verbal exchanges or instances of helping will therefore fail to capture the whole construct.

2.2. Peer interaction, social competence, and emotional regulation

Peer competence develops through repeated participation in increasingly complex forms of interaction. Howes identified developmental sequences in young children's social competence with peers, emphasizing that peer interaction is not a single behavior but a progression from simple social contact toward sustained, reciprocal, and organized activity [3]. The educational significance of this progression is clear: children who can initiate and maintain interaction have more opportunities to practice language, negotiate roles, and receive feedback from peers.

Cooperation also depends on emotional competence. Denham and colleagues showed that preschool emotional competence is closely connected with later social competence [7]. A child who can identify feelings, regulate frustration, and interpret another person's emotional state is better positioned to continue a joint task when disagreement occurs. Emotional regulation is particularly important because collaborative work produces natural moments of tension: two children may want the same material, prefer different designs, or interpret the goal differently. These moments are not failures of pedagogy. When appropriately supported, they are the situations in which cooperation skills become observable and teachable.

Classroom interaction quality shapes the opportunities available for such learning. Mashburn and colleagues found that the quality of teacher-child interactions in prekindergarten classrooms predicted aspects of children's academic, language, and social development [8]. Bierman and colleagues demonstrated that an integrated preschool intervention could strengthen social-emotional school readiness alongside academic readiness [9]. Together, these studies support a view of cooperation as part of the broader ecology of classroom quality: group tasks are more productive when they occur in an emotionally supportive environment where teachers model respectful communication, establish predictable routines, and respond to conflict without taking control of every decision.

2.3. Cooperative problem solving, planning, and peer learning

Cooperative problem solving adds an intellectual dimension to joint activity. Gauvain and Rogoff showed that collaboration can contribute to children's planning skills when partners coordinate their knowledge and actions [4]. Azmitia's study of five-year-old children demonstrated that peer interaction may support problem solving under particular conditions, especially when partners bring complementary competence and the task permits them to exchange strategies [5]. These findings caution against the simplistic assumption that any pair will automatically outperform an individual. Group composition, task structure, and the quality of interaction determine whether the social setting becomes cognitively productive.

Ramani and Brownell argue that play provides a particularly suitable context for preschool cooperative problem solving because children can create and sustain joint goals more naturally in play than in tightly controlled laboratory tasks [11]. The flexibility of play allows children to negotiate what the object represents, what roles are required, and how the activity will continue. This flexibility does not mean that adults have no role. Rather, the adult creates conditions in which children retain agency while receiving enough support to remain oriented to the common task.

Guided play provides a useful pedagogical balance. Weisberg and colleagues describe guided play as a child-centered context with an explicit learning goal and sensitive adult guidance [12]. In cooperative tasks, guidance may involve posing an open question, drawing attention to a partner's idea, or asking how two separate products could be combined. It should not consist of assigning every action or resolving every disagreement for the children. When support is too directive, children may complete the product successfully while having few opportunities to practice planning, negotiation, and conflict resolution.

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2.4. Play-based pedagogy and recent intervention evidence

A broad review of play-based pedagogy by Pyle, DeLuca, and Danniels shows that early-years practice exists along a continuum from free play to highly structured teacher-directed activity [13]. Cooperation can be developed at different points on this continuum, but the mechanisms differ. Free play offers strong child ownership and authentic negotiation, while structured collaborative tasks make the shared goal and interdependence easier to observe. A balanced program should therefore include both naturally occurring peer play and deliberately designed joint tasks.

Recent intervention evidence provides direct support for systematic cooperative play. Lin and colleagues reported that cooperative constructive play strengthened cooperation among five- to six-year-old children in a quasi-experimental study [14]. The relevance of constructive play lies in its material interdependence: children must share space, select and distribute materials, coordinate structural decisions, and respond visibly to the consequences of one another's actions. The joint product becomes an external reference point that supports communication even when children's verbal abilities differ.

The most recent evidence also highlights multimodal communication. Sormunen, Yliverronen, and Rönkkö examined four- to six-year-old children during hands-on collaborative problem solving and identified a progression from solitary activity and side-by-side participation toward action-based and verbally interactive collaboration [15]. Their findings show that gestures, positioning, handling materials, imitation, and embodied support can be as important as speech. This is especially relevant in inclusive preschool groups, where children may differ in language proficiency, confidence, or support needs.

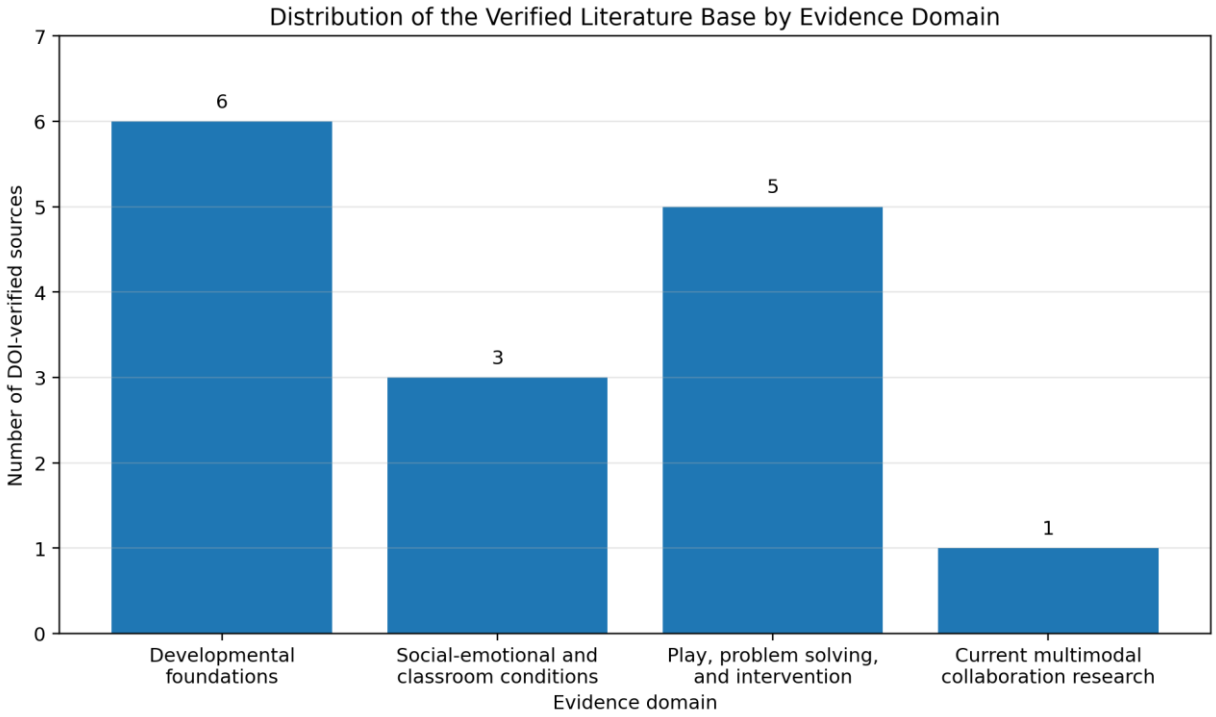


Chart 1. Distribution of the DOI-verified literature base by evidence domain.

Note. The chart is a descriptive evidence map of the fifteen sources retained in the revised manuscript. It does not represent effect sizes or participant data. Sources were coded according to their primary contribution to developmental foundations, social-emotional and classroom conditions, play/problem-solving/intervention, or current multimodal collaboration research.

3. Materials and Methods

3.1. Study design and source verification

The present article uses a theory-building and methodology-development design. It combines a focused narrative synthesis of peer-reviewed literature with the construction of a proposed empirical protocol. The literature was selected according to four criteria: direct relevance to cooperation, peer interaction, collaborative problem solving, play-based learning, or social-emotional competence in early childhood; publication in a traceable scholarly outlet; availability of a verifiable DOI; and sufficient

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methodological or theoretical detail to support the article's framework. The retained literature spans foundational developmental studies and recent intervention and multimodal research.

Reference verification was conducted by matching author names, article title, journal, year, volume, page range or article number, and DOI against publisher pages, PubMed records, or DOI landing pages. Sources that could not be confirmed at this level were excluded from the revised reference list. This procedure does not establish that every retained study has equal methodological quality; rather, it ensures that the citations correspond to identifiable publications and that readers can retrieve the original record.

3.2. Proposed participants and setting

A future empirical study may recruit approximately sixty children aged five to six from two or more comparable preschool groups. The use of more than one classroom is preferable because cooperation is influenced by classroom climate, teacher practices, friendship patterns, and previous experience with group activity. Children should be assigned at the classroom or subgroup level rather than individually when individual randomization would disrupt established educational routines. One group would receive a structured cooperation-focused program, while the comparison group would continue with the regular curriculum.

Participation should require parental or guardian consent and age-appropriate child assent. Children should be free to decline a video-recorded task or leave an activity without academic or disciplinary consequences. Personal identifiers should be replaced with codes, recordings should be stored securely, and publications should use aggregated results or anonymized behavioral examples. Children with language differences or additional support needs should not be excluded automatically; instead, the observation system should recognize nonverbal participation and embodied communication, consistent with recent multimodal research [15].

3.3. Proposed formative program

The formative program may run for twelve weeks, with two cooperation-focused sessions per week. Each session would last approximately twenty-five to thirty minutes and include four phases. First, the educator introduces a meaningful common goal, such as constructing a bridge for toy animals, creating a shared map, preparing a group collage, designing a shelter, or dramatizing a story. Second, children examine the available materials and propose possible roles. Third, the group completes the task while the educator observes and provides calibrated prompts only when interaction has stalled or exclusion has become persistent. Fourth, the children briefly reflect on what helped the group work together.

Task difficulty should increase gradually. Early tasks may involve pairs, a limited set of materials, and two clearly complementary roles. Later tasks may involve groups of three or four, several possible solutions, and roles that must be renegotiated during the activity. Progression is essential because a task that is too easy may require little coordination, whereas a task that is too difficult may create frustration that overwhelms the children's developing regulatory capacities.

Adult prompts should be standardized sufficiently for research while remaining natural for preschool practice. Examples include: 'What are you making together?'; 'How will each person help?'; 'I heard two different ideas—how can the group decide?'; 'What does your partner need to continue?'; and 'What could you change so both parts fit?' These prompts direct attention to the process of cooperation without providing the solution. Educators should avoid praise that focuses only on speed or the final product, because this can encourage dominant children to take over. Feedback should instead acknowledge observable collaborative processes, such as listening, combining ideas, or helping a partner re-enter the activity.

3.4. Proposed observation instrument

The revised paper proposes a Cooperation Skills Observation Rubric for Preschool Children. The rubric is not presented as a previously validated standardized test; it is a research instrument to be piloted and refined. It organizes observation into five domains derived from the verified literature: shared goal

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maintenance, role coordination, communication and negotiation, mutual assistance, and constructive conflict resolution. Each domain is scored from 0 to 3, where 0 indicates that the behavior is absent or the interaction breaks down, 1 indicates emerging and inconsistent performance, 2 indicates functional performance with occasional adult support, and 3 indicates sustained independent performance.

Table 1

Operational Framework for Observing Preschool Cooperation Skills

Domain	Core question	Examples of observable behavior	Score interpretation
Shared goal maintenance	Do children orient to one joint outcome?	Refer to a common product; monitor group progress; return attention to the shared task.	0 absent; 1 unstable; 2 functional with support; 3 sustained independently
Role coordination	Are actions divided and connected?	Propose roles; accept or renegotiate roles; sequence complementary actions.	0 parallel/competing actions; 1 unclear division; 2 coordinated with prompts; 3 flexible independent coordination
Communication and negotiation	Do children exchange and combine ideas?	Explain, ask, listen, clarify, gesture, compare alternatives, and reach a decision.	0 no exchange; 1 one-sided exchange; 2 reciprocal with support; 3 sustained reciprocal negotiation
Mutual assistance	Do children respond to partners' needs?	Share materials, demonstrate, wait, encourage, offer help, and invite participation.	0 obstructs/ignores; 1 occasional help; 2 appropriate help with prompts; 3 spontaneous and well-calibrated help
Conflict resolution	Can disagreement be repaired constructively?	Name the problem, propose compromise, use turn-taking, accept revision, and resume joint work.	0 task ends/escalates; 1 adult solves; 2 children solve with prompts; 3 children resolve and continue independently

The composite score ranges from 0 to 15, but the domain profile is more informative than the total alone. Two groups may obtain the same total for different reasons: one may communicate well but divide roles poorly, while another may coordinate actions effectively with little verbal discussion. The rubric should therefore be analyzed both by domain and as a composite measure. Observers should also record short field notes describing the interactional sequence, because a numerical score cannot show how a conflict began, how a child was excluded, or which prompt enabled the group to recover.

3.5. Reliability and validity procedures

Before the main study, the rubric should be reviewed by experts in preschool pedagogy, developmental psychology, and educational measurement. A pilot with approximately ten to fifteen children can identify unclear indicators and tasks that do not create genuine interdependence. At least twenty percent of the video recordings should be coded independently by two trained observers. Agreement may be evaluated with weighted kappa for individual ordinal domains and an intraclass correlation coefficient for the composite score. Disagreement should be resolved only after independent scores have been preserved, so that reliability estimates are not artificially inflated.

Content validity would be supported by linking each domain to the literature and by expert review. Construct validity may be explored by testing whether the five domains are positively related but not redundant. Sensitivity to change would be examined by comparing pre-intervention and post-intervention scores. Ecological validity requires tasks that resemble meaningful preschool activity rather than abstract tests. For this reason, at least two task types should be used, such as a joint construction task and a collaborative story or art task.

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3.6. Proposed data analysis

Baseline comparability should be examined for age, attendance, language background, and initial cooperation scores. Because the rubric produces ordinal domain scores and the expected sample is modest, analyses should not rely automatically on normal-distribution assumptions. Within-group change may be tested using the Wilcoxon signed-rank test, and post-intervention group differences may be examined with the Mann-Whitney U test after inspecting baseline balance. A more informative approach, if the sample and distribution permit, is an ordinal mixed-effects model with time, group, and their interaction as fixed effects and child or dyad and classroom as random effects.

Statistical significance should be accompanied by effect sizes and confidence intervals. The analysis should also report participation and implementation fidelity: how many sessions each child attended, how often the planned tasks were completed, and whether educators used prompts consistently. Qualitative field notes and selected anonymized interaction sequences can explain why a score changed. This mixed-methods logic is particularly suitable for cooperation, because the same numerical improvement can emerge through different developmental pathways.

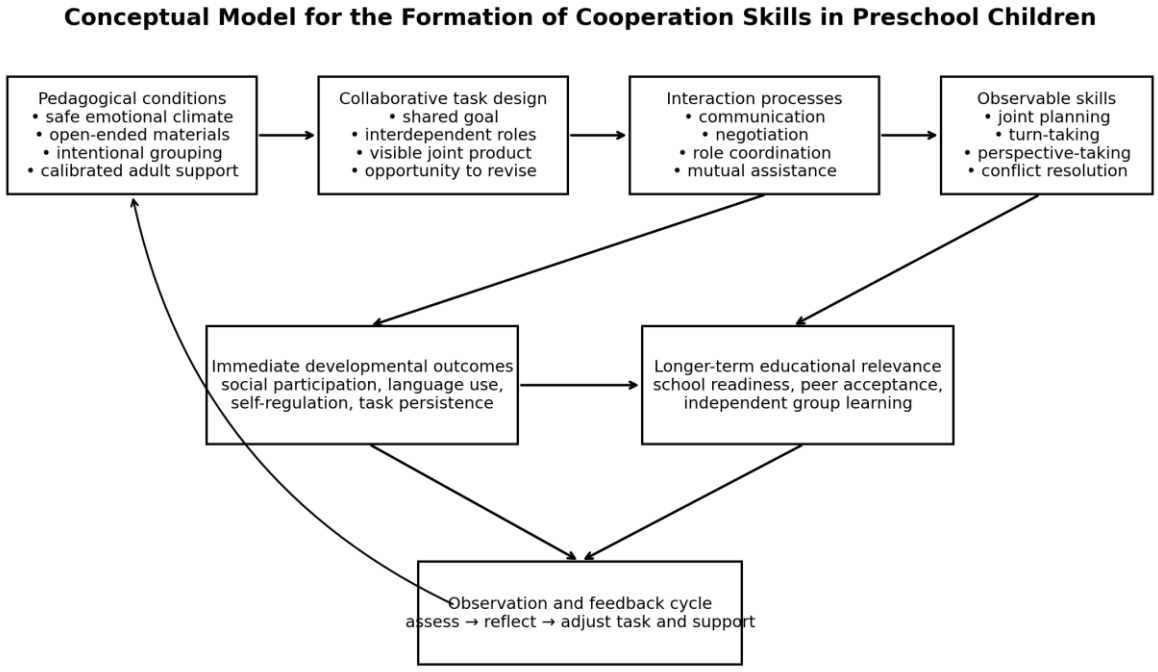


Figure 1. Conceptual model for the formation and assessment of cooperation skills in preschool children.

Note. The model treats cooperation as the result of an interaction between pedagogical conditions, collaborative task design, children's communication and coordination processes, and iterative observation. The arrows represent hypothesized pathways to be tested in future empirical research.

4. Results of the Literature Synthesis

4.1. Cooperation is goal-dependent rather than proximity-dependent

The first consistent finding is that a shared goal is the organizing feature of cooperation. Children sitting together or using the same materials are not necessarily cooperating. Genuine collaboration becomes more likely when the task has one visible outcome that cannot be completed efficiently by isolated parallel action. Shared intentionality research explains why common knowledge of the goal matters [1], while cooperative activity studies show that young children can coordinate complementary roles when the structure of the task makes interdependence meaningful [6].

This result has direct implications for task design. An instruction such as 'everyone draw a house' creates a group setting but not necessarily a joint goal. An instruction such as 'create one neighborhood on this large sheet, with roads that connect every house' creates interdependence and gives children a reason

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to communicate. The joint product also functions as an external memory: children can point to it, compare parts, and identify what remains to be done.

4.2. Cooperation combines social, emotional, and cognitive processes

The second result is that cooperation cannot be reduced to social politeness. Planning, monitoring, and revising are cognitive processes; listening and explaining are communicative processes; waiting and tolerating disagreement involve emotional regulation; and recognizing a partner's contribution involves social cognition. Research on emotional competence [7], planning [4], peer problem solving [5], and classroom interaction quality [8] converges on this integrated view.

For assessment, this means that educators should not classify a quiet child automatically as uncooperative. A child may contribute through careful material selection, imitation, timing, or nonverbal coordination. Conversely, a highly verbal child may dominate the task without integrating partners' ideas. Multimodal observation is therefore necessary, particularly in linguistically diverse and inclusive settings [15].

4.3. Productive conflict is part of learning to cooperate

The third result is that disagreement is not the opposite of cooperation. It is one of the conditions through which cooperation develops. Children need experience expressing different preferences, hearing reasons, proposing alternatives, and returning to a shared task. If adults eliminate every conflict immediately, children may remain dependent on external authority. If adults ignore persistent exclusion or escalation, the task may become emotionally unsafe. Effective scaffolding lies between these extremes.

A useful educator response is to clarify the problem without deciding the outcome: 'You both want the long block, and the bridge needs two sides. What can the group do?' This type of prompt protects participation while leaving the children responsible for negotiation. The observation rubric therefore treats constructive conflict resolution as a distinct domain rather than as the absence of conflict.

4.4. Play and construction tasks offer complementary advantages

The fourth result is that play-based and structured tasks should not be treated as mutually exclusive. Free or child-initiated play offers ownership, imagination, and authentic role negotiation. Guided play preserves child agency while focusing attention on a pedagogical goal [12]. Structured construction tasks create visible interdependence and make collaboration easier to observe. Reviews of play-based pedagogy emphasize that quality depends on how freedom and guidance are combined rather than on selecting one pure model [13].

Constructive play appears especially promising for intervention because it produces a shared object and repeated opportunities for planning and revision. The recent quasi-experimental findings of Lin and colleagues support the use of cooperative constructive play with five- to six-year-old children [14]. Hands-on problem-solving research also demonstrates that materials and embodied action can support collaboration when verbal communication is still developing [15].

4.5. Adult support should be calibrated and temporary

The fifth result concerns the educator's role. Cooperation does not emerge reliably from nonintervention, but excessive direction can remove the very decisions children need to practice. Effective support is contingent: the educator observes the specific barrier, offers the least intrusive prompt likely to restore productive interaction, and then withdraws. Support may focus on the goal, participation, communication, or regulation, depending on the problem.

For example, if a group has no shared plan, the educator may ask what the completed product should do. If one child is excluded, the educator may ask the group which role is still needed. If children cannot choose between ideas, the educator may suggest testing both or combining elements. The purpose is not to ensure a perfect product but to increase children's capacity to manage the next collaborative problem with less assistance.

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5. Discussion

The literature synthesis supports a developmental-pedagogical model in which cooperation is learned through repeated participation in meaningful, interdependent activity. The model differs from approaches that rely on verbal instruction about being friendly or sharing. Rules and stories may introduce expectations, but skills become functional only when children must apply them while pursuing a real common goal. Cooperation is therefore best understood as situated performance that gradually becomes more stable and transferable.

The proposed five-domain framework extends the original paper's emphasis on shared goals, division of functions, and positive relationships. Shared goal maintenance and role coordination preserve those central elements, while communication, mutual assistance, and conflict resolution make the interactional process more observable. This expanded framework also reflects evidence that cooperation may be expressed verbally and nonverbally, and that emotional regulation is essential to sustaining joint activity.

The framework has practical value because it separates the child's current performance from the educator's support. A score of 2 indicates that the behavior is functional with occasional prompting, whereas a score of 3 indicates independent and sustained use. This distinction allows educators to observe developmental progress even when the final product looks similar. It also prevents adult-assisted completion from being misinterpreted as independent cooperation.

The framework should not be used to label children as cooperative or uncooperative personalities. Performance is task- and context-dependent. A child may coordinate effectively with a familiar friend but withdraw in an unfamiliar group; another may perform well in construction but struggle in dramatic play. Repeated observation across partners, tasks, and days is necessary. The educational goal is to broaden each child's repertoire and participation, not to rank children publicly.

The proposed design also recognizes that cooperation develops within relationships and classroom systems. Teacher interaction quality, group composition, friendship, language proficiency, attendance, and previous experience can all influence performance. A future empirical study should therefore report these contextual factors rather than attributing every change to the intervention. Including more than one classroom and modeling classroom-level variation would strengthen the evidence.

The verified literature also reveals an important balance between developmental appropriateness and methodological rigor. Natural play captures authentic cooperation but can be difficult to compare because goals and materials vary. Standardized tasks support comparison but may reduce children's ownership. Using two complementary tasks and combining ordinal scoring with qualitative interaction sequences offers a practical compromise. Video recording, where ethically approved, permits repeated observation of gestures, timing, and subtle forms of support that may be missed in real time.

6. Practical Recommendations for Preschool Educators

First, design tasks around one meaningful common outcome. A shared mural, bridge, model town, puppet performance, garden plan, or group story is more likely to generate coordination than identical individual worksheets. The task should make each contribution visible and should require children to connect their work.

Second, begin with pairs and gradually move toward groups of three or four. Pairs reduce coordination demands and make participation easier to observe. Larger groups provide richer opportunities for role distribution and negotiation but also increase the risk of passive participation or dominance.

Third, use materials that invite more than one solution. Open-ended blocks, recycled construction materials, large-format paper, loose parts, puppets, and story cards allow children to combine ideas. Materials should be sufficient for exploration but not so abundant that children can complete separate products without interaction.

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Fourth, teach the language of cooperation in context. Useful sentence frames include 'What is our plan?', 'Can you show me your idea?', 'Which part will you do?', 'I need help with…', 'Let us try both ideas', and 'How can we fix this together?' These expressions should be modeled during real tasks rather than memorized in isolation.

Fifth, observe before intervening. Short pauses are developmentally productive because children need time to initiate, process, and respond. Intervention is necessary when safety, dignity, or participation is at risk, but ordinary uncertainty should not be mistaken for failure.

Sixth, end tasks with brief reflection. Children may be asked what helped the group, when the plan changed, how a disagreement was solved, or what they would do differently next time. Reflection converts an experience into language and helps children recognize cooperation as a process they can intentionally improve.

Seventh, communicate with families about the purpose of cooperative tasks. Parents may focus primarily on the appearance of the final product. Educators can explain that a less polished group construction may represent more valuable learning if children planned, negotiated, and revised it themselves.

7. Limitations and Directions for Future Research

This article does not report primary data, and the proposed intervention and observation rubric must not be represented as empirically validated. The literature synthesis is focused rather than systematic; it was designed to construct a practical framework, not to estimate an overall effect size. Although all retained sources were bibliographically verified and have DOI records, they differ in design, cultural context, participant age, and outcome measures.

The proposed rubric requires pilot testing, expert review, inter-rater reliability analysis, and examination of construct validity. Its four-level scoring system may need revision if observers cannot distinguish adjacent categories consistently. Future research should also evaluate whether the rubric functions similarly across languages, cultures, disability categories, and preschool curricula.

A single-institution quasi-experiment would provide useful initial evidence but would remain vulnerable to teacher effects, friendship networks, and selection bias. Stronger future designs could include several institutions, cluster randomization, blinded video coding, delayed follow-up, and measures of transfer to ordinary free play. Research should also examine whether gains persist when children work with unfamiliar peers and whether cooperation predicts later school adjustment.

8. Conclusion

Cooperation in preschool children is a complex, teachable competence rather than an automatic result of group attendance. It develops when children repeatedly participate in meaningful activity organized around a common goal, complementary contributions, communication, mutual support, and opportunities to resolve disagreement. Play, guided activity, and joint construction each provide valuable contexts when they preserve child agency and create real interdependence.

The revised paper replaces unverified references with a coherent set of fifteen DOI-confirmed scholarly sources and translates that evidence into a practical methodological framework. The proposed observation rubric and quasi-experimental design offer a transparent basis for future empirical work. Their central implication is that educators should evaluate not only whether children complete a group product but how they plan, coordinate, communicate, assist one another, and recover from conflict. When these processes are intentionally scaffolded and observed, preschool cooperation can contribute to social participation, emotional regulation, language development, problem solving, and readiness for later collaborative learning.

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PEDAGOGICAL CONDITIONS AND DIDACTIC OPPORTUNITIES FOR DEVELOPING PRE-SERVICE PRIMARY SCHOOL TEACHERS' SKILLS IN USING STEAM TECHNOLOGY

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ABSTRACT

This article examines the pedagogical conditions and didactic opportunities for developing pre-service primary school teachers' skills in applying STEAM technology. It highlights the growing importance of practice-oriented education in contemporary pedagogy and analyzes the pedagogical conditions and didactic possibilities involved in shaping future primary school teachers' competence in using STEAM technology. The study explores the potential of interdisciplinary integration, design thinking, contextual teaching, and the broader STEAM approach in teacher preparation.

ACCEPTED

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Keywords: *STEAM, primary education, pre-service teacher, interdisciplinary integration, design thinking, contextual teaching, pedagogical conditions, didactic opportunities, critical thinking, innovative education.*



Introduction

Contemporary pedagogy increasingly emphasizes practice-based education aimed at equipping pre-service teachers with the professional knowledge and skills they need, while also helping them understand where, how, and for what purpose these should be applied.

Worldwide, the extensive use of scientific and technological achievements in education is widely recognized as one of the key factors ensuring the consistent and sustainable development of every sphere of society and the state, thereby securing a nation's future. From this standpoint, training highly competent and competitive specialists, together with the broad introduction of innovative, modern, interactive, and creative teaching methods into the educational process, plays a crucial role in developing students' capacity

for scientific inquiry, grounded in their motivational, cognitive, operational, reflective, and self-assessment indicators[1].

Methods

Implementing STEAM technology involves several key requirements[2]:

1. Applying the technology across all levels of education. The technology should be introduced into school and university education systems simultaneously, which requires updating and harmonizing primary, secondary, and higher education curricula. In American schools, for instance, STEAM has already been incorporated into the primary curriculum, while specialization is provided for at the secondary and upper levels; schools also run collaborative programs with universities and business partners. Local general-education institutions maintain a dedicated subject area called "Technology," within which particular attention is devoted to programming, biology, physics, and mathematics. It is equally important to introduce, or further develop, project-based practical activities, problem-solving exercises, and the design of technological and engineering structures.

2. Reforming teacher training and retraining systems is one of the key conditions for the development of contemporary education, since today's teachers must possess the knowledge, skills, and competencies required to work effectively within new curricula. To this end, many countries are developing and implementing dedicated support programs for teachers, with active participation not only from government agencies but also from commercial organizations. In particular, in the United States and the countries of the European Union, state-level platforms — including centers such as the National STEAM Centre — support teacher training and professional development by offering methodological resources, didactic materials, and innovative approaches that assist universities and schools in the teaching process.

3. Establishing close cooperation among schools, universities, and industry is one of the key strategic directions of the modern education system. Integrating student projects and school teachers into the research and educational programs of universities supports the continuous professional development of teachers and, in turn, contributes positively to raising the overall quality of education. At the same time, strengthening cooperation with urban industry, the community, and local governance bodies when defining educational goals and objectives is important, since this approach increases the social responsibility of the education system and directs it toward addressing pressing societal problems. As a result, the educational process becomes more practical, adaptable, and professionally oriented, creating conditions for the broad-scale development of innovative activity.

Furthermore, practice-based teaching directly affects an individual's activity and emotional intelligence; it encompasses a system of tools, forms, and methods that ensure students' active participation under conditions close to a genuine professional environment. It encourages learners to acquire integrated scientific, technical, engineering, artistic, and mathematical knowledge through group learning and experimental research, and it serves to build the complex competencies demanded by contemporary society[3].

STEAM education serves to cultivate critically thinking individuals, enhance scientific literacy, and nurture innovators, with pre-service teachers acting as the principal and decisive agents of this process.

[1]Schleicher A. World-Class: How to Build a 21st-Century School System. Moscow: Natsionalnoe Obrazovanie Publishing, FIOKO, 2019. 24 p. (in Russian).

[2]Active learning narrows achievement gaps for underrepresented students in undergraduate science, technology, engineering, and math. Proceedings of the National Academy of Sciences, March 2020, vol. 117, no. 12, art. 201916903. DOI: 10.1073/pnas.1916903117.

[3]Cortázar C., Nussbaum M., Harcha J., Alvares D., López F., Goñi J., Cabezas V. Promoting critical thinking in an online, project-based course. Computers in Human Behavior, 2021, vol. 119, art. 106705.

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According to The National STEAM School Education Resources Toolkit[4], pre-service teachers must observe a number of important methodological and professional principles in order to effectively implement the STEAM approach — principles that help organize the educational process on an integrated, practice-oriented, and innovative basis.

These principles are not necessarily applied uniformly in every situation, yet each provides important guidance:

1. Inquiry-based learning. This approach encourages investigation and problem-solving. Through this type of learning, students acquire essential life skills such as social interaction, inquiry, discussion, and the ability to accept failure. Pre-service teachers, for example, create active learning environments that foster critical thinking based on problem-driven scenarios.

2. Teaching students to solve real-world problems. Students attempt to solve genuine problems drawn from business and society. Such problems, by demonstrating their relevance, increase motivation and interest.

3. Integrated education — the practice of teaching two or more subjects together. This approach develops interdisciplinary skills and increases students' interest. A teacher may, for example, teach physics through an engineering-design approach, that is, through the stages of designing a product or system.

4. Use of technology. Purposeful use of technology improves the quality of education, engages students in the learning process, and increases their confidence in using technology. Rather than simply demonstrating ready-made technology, for instance, a teacher may assign students to program it themselves.

5. Differentiation of the learning process. The learning process is adapted to each student's needs and abilities, ensuring that every student's development is supported regardless of their starting level. A teacher may, for example, adjust lesson content based on a formal and informal assessment of students' abilities.

6. Linking education to twenty-first-century skills. Teachers focus on developing skills such as critical thinking, creativity, communication, and collaboration, since these are essential to students' future careers.

These principles ensure that pre-service teachers thoroughly master contemporary natural-scientific knowledge, advanced technologies, modeling, and practice-oriented educational strategies. Such an integrative approach helps shape teachers as creative, innovative thinkers with deep professional competence. As a result, a teacher becomes not merely a specialist who delivers subject content, but a leading agent who develops students' capacity for independent inquiry, problem-solving, and creative thinking. It is therefore essential, in preparing pre-service primary school teachers, to ensure the pedagogical conditions that support the effective organization of learning activities (Figure 1).

Preparing teaching staff to develop and implement STEAM technology in practice is one of the key factors in modernizing contemporary education. According to recent research, a teacher's readiness to create and apply pedagogical technologies is recognized as a fundamental condition for the effective implementation of innovative pedagogical activity. This is because a pre-service primary school teacher's readiness for innovative activity is determined by their professional and personal qualities, their orientation toward professional growth, their capacity for the independent and active mastery of new knowledge and materials, their ability for creative self-expression, and their potential to develop innovative methods and tools for pedagogical practice[5].

[4]The Australian Government Department of Education. Best Practice Guide: Elements of Successful School-Industry STEAM Partnerships. The National STEAM School Education Resources Toolkit, 2019.

[5]Pisarenko V.I. The System of Innovative Humanitarian Education in a Technical University: Monograph. Ed. by A.V. Nepomnyashchiy. Taganrog: TTI SFU Publishing House, 2007. 376 p. (in Russian).

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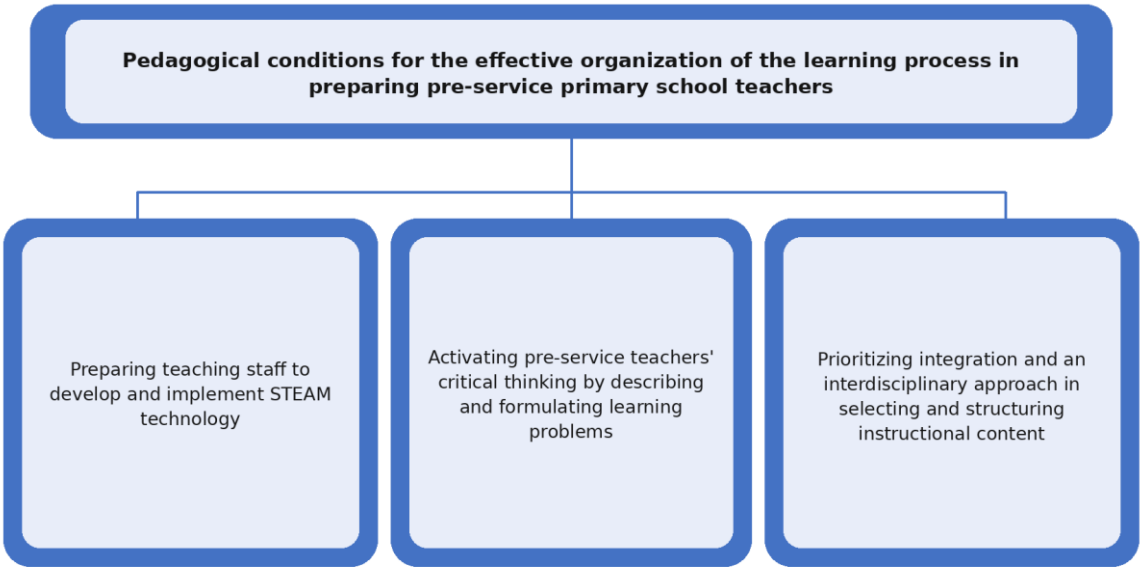


Figure 1. Pedagogical conditions for the effective organization of the learning process in preparing pre-service primary school teachers

Activating students' critical thinking by describing and clearly formulating a learning problem is an important pedagogical mechanism. As M. Makhmutov notes, the ideas of problem-based learning and critical thinking express the need to combine a critical approach to education with problem-oriented, developmental learning[6]. In other words, a teacher should not simply limit themselves to presenting ready-made, scientifically grounded conclusions, but should also guide students toward posing a problem, formulating it, and proposing hypotheses. Because the process of substantiating a hypothesis involves weighing alternative views and the possibility of refutation, a critical approach is particularly important at this stage. This view is likewise supported by D. Shakirova, who emphasizes the need to synthesize elements of problem-based learning with methods for developing critical thinking, interpreting the latter as an integrative form of logical reasoning[7]. Furthermore, in contemporary research the concepts of "problem solving" and "problem-solvers" are regarded as core principles for understanding the essence of critical thinking.

Prioritizing integration and an interdisciplinary approach in selecting and structuring instructional content is an important didactic factor in ensuring educational effectiveness. In developing curricula, selecting content and organizing it in a structurally sound manner brings together knowledge from different disciplines and ensures thematic connections, thereby achieving the integration of subjects. The need to adapt to continuous change in education and practice has broadened the contemporary requirements placed on professional training in higher education, recognizing interdisciplinary mobility — and not merely a set of competencies — as an essential skill for specialists. In this regard, interdisciplinary integration serves as a logical and necessary foundation for the professional and personal development of future specialists.

As noted above, "...the primary goal of STEAM technology is to develop learners' capacity for critical and creative thinking, shaping them into creative individuals capable of solving real-life problems. Interdisciplinary integration is the principal didactic criterion for achieving this goal, allowing knowledge to be formed as a coherent system by linking the technical and natural sciences with the arts"[8].

[6]Makhmutov M.I. Problem-Based Learning: Fundamental Questions of Theory. Moscow: Pedagogika, 2005. 368 p. (in Russian).
[7]Shakirova D.M. Developing critical thinking in schoolchildren and students: model and technology. Educational Technologies and Society, 2006, no. 9, pp. 284–292. (in Russian).
[8]Tilavova S. Methods for developing the environmental competence of pre-service primary education teachers based on the STEAM approach. Teacher and Lifelong Education (scientific-methodological journal). Nukus, 2025, no. 1, pp. 308–312. (in Uzbek).

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Results

Moreover, contemporary pedagogical research emphasizes that introducing this technology into the educational process significantly enhances the levels of learning, motivation, and thinking. It is therefore essential to prepare pre-service teachers specifically within this integrative approach, since the effectiveness of the process depends directly on the competence of the teachers who apply it in practice. The didactic opportunities for developing pre-service primary school teachers' skills in using STEAM technology are analyzed below (Table 2).

Table 2.

Didactic opportunities for developing pre-service primary school teachers' skills in using STEAM technology

Concept	Didactic opportunities	Role in preparing pre-service primary school teachers
Interdisciplinary integration	Presenting instructional material as a coherent whole; applying knowledge at the intersection of different subject areas.	Develops the skill of designing lessons on an integrative basis across various fields and subjects, systematizing knowledge, and engaging student interest.
Design thinking	Fostering creative, real-life, and project-based problem-solving; cultivating creative and critical thinkers.	Develops the ability to design real-life, creative, project-based lessons, along with facilitation, collaboration, and active-inquiry skills.
Contextual teaching	Narrowing the gap between theory and practice; strengthening interest and retention by connecting knowledge with life.	Develops the ability to explain topics through real-life situations and needs, helping students adapt to the cultural and social environment.
Experiential and constructivist learning	Practical orientation; learning through experience; teamwork; moving from passivity to creativity, and from "learning by reading" to "learning by building."	Reinforces an activity-based approach, an understanding of constructivism, process management, "learning to teach," and independent thinking.

According to S. B. Tilavova, a researcher who has studied the integrative characteristics of the technology, interdisciplinary integration is one of the core principles of STEAM education: whereas subjects are taught separately in traditional education, this approach presents them in unified form within a single theme. Such an integrative approach enables students to understand knowledge in various contexts, apply theoretical knowledge in practice, and develop interdisciplinary thinking skills for solving complex problems. At the same time, integrated teaching increases primary school students' interest in the learning material and helps them develop a holistic worldview[9].

The main didactic advantages of interdisciplinary integration can be described as follows:

Thematic integration. Here, "...academic subjects are taught not separately, but united around a single theme. In this process, interdisciplinary connections and the project method are applied together, creating opportunities to closely link the natural sciences with technology and engineering, and

[9]Tilavova S. Methods for developing the environmental competence of pre-service primary education teachers based on the STEAM approach. Teacher and Lifelong Education (scientific-methodological journal). Nukus, 2025, no. 1, pp. 308–312. (in Uzbek).

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mathematics with art"[10]. For example, when teaching the topic "Weather and Seasons" in primary school, natural science content can be integrated with art, allowing children to create drawings or handicrafts depicting the seasons with their own hands. As a result, they simultaneously acquire scientific concepts and creative skills.

Applying scientific knowledge to real life. During practical exercises, learners create models and conduct experiments using modern technologies or simple everyday tools, thereby observing how the laws they have studied manifest in real life. When teaching the topic "Air Pressure," for instance, instead of merely explaining formulas and rules, a teacher can demonstrate the concept of pressure practically — by inflating a balloon and observing its expansion, or through the classic glass-and-water experiment — thus connecting the topic to everyday life.

Developing critical and problem-based thinking. When presenting a topic, critical thinking can be developed through questions such as "Why did this happen?" and "Which solution is more effective?" Teaching students to analyze and correct errors after each trial further reinforces their problem-solving skills.

Creativity and an innovative approach. "...since the approach also incorporates art and design, it serves to develop creative thinking. Children imagine themselves in the roles of discoverers, scientists, engineers, and designers, striving toward research and discovery"[11], which encourages unconventional thinking. During project work in particular, proposing various ideas and creating new products through manual work and an artistic approach enhances creativity, while the process simultaneously combines engineering thinking (structural stability, calculating dimensions) with artistic taste (attractive design detailing).

Collaboration and communication skills. "...STEAM lessons are usually conducted in the form of team project work. While working in a group, students learn to communicate with one another, exchange ideas, and defend their own opinions. Each child contributes to the shared goal by fulfilling an assigned role within the team"[12]. As a result, primary school students develop communication, teamwork, and leadership skills, while pre-service teachers strengthen their ability to organize collective activities.

Discussion

These considerations clearly show that it is extremely important for pre-service primary school teachers to possess the skill of designing STEAM lessons on the basis of interdisciplinary integration, since this skill enables them to convey knowledge systematically at the intersection of different disciplines and to organize lessons capable of engaging every student's interest.

In preparing pre-service primary school teachers to use STEAM technology, developing design-thinking and contextual-teaching skills is of particular relevance. These are discussed in detail below.

According to a group of researchers who have studied this topic, "...design thinking means applying the approach characteristic of designers to problem-solving within the educational process. Its essence lies in deeply understanding and analyzing the problem, generating new ideas, creating a prototype, and then testing and refining it. It is an excellent methodological framework for developing STEAM education"[13]. Design thinking helps organize the learning process creatively, in a manner oriented toward real life and

[10]Tilavova S. Methods for developing the environmental competence of pre-service primary education teachers based on the STEAM approach. Teacher and Lifelong Education (scientific-methodological journal). Nukus, 2025, no. 1, pp. 308–312. (in Uzbek).

[11]Henriksen D., Mehta R., Mehta S. Design Thinking Gives STEAM to Teaching: A Framework That Breaks Disciplinary Boundaries. In: Khine M.S., Areepattamannil S. (eds.). STEAM Education: Theory and Practice, 2019, pp. 54–78.

[12]Tilavova S. Methods for developing the environmental competence of pre-service primary education teachers based on the STEAM approach. Teacher and Lifelong Education (scientific-methodological journal). Nukus, 2025, no. 1, pp. 308–312. (in Uzbek).

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based on projects. A teacher who applies it skillfully moves away from the traditional model of "delivering ready-made knowledge" and instead directs students toward active inquiry and creation. The design-thinking algorithm consists of the following sequence (Figure 3).

Problem posing (defining the task): the problem (task) to be solved within the lesson or project is identified. The teacher presents the problem simply and clearly, generating motivation among students.

Discussion (empathy and idea exchange): the problem is discussed in detail within groups, and various solutions are proposed.

Design (planning the idea): following discussion, a detailed plan is developed for the chosen solution, a list of necessary materials is compiled, and the sequence of work is determined.

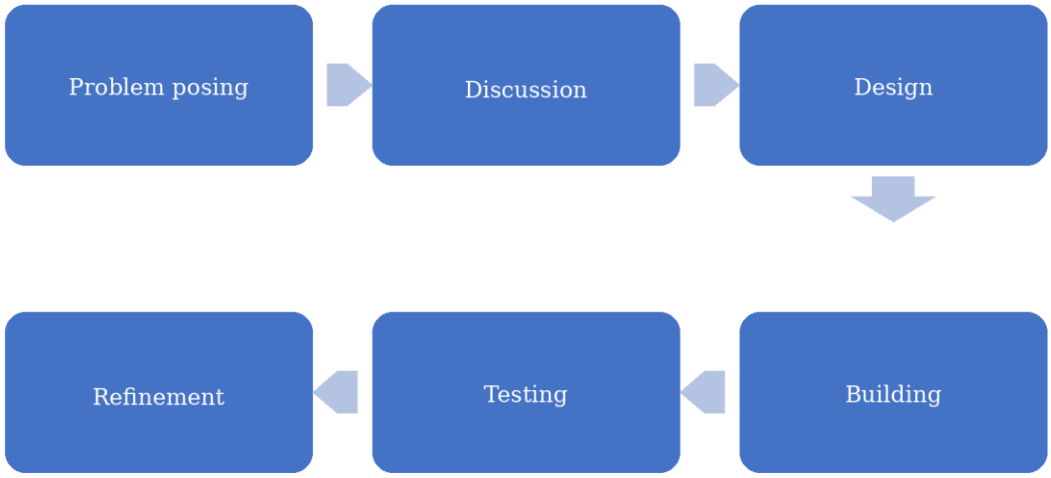


Figure 3. The design-thinking algorithm in STEAM education

Building (creating a prototype): groups begin creating a prototype of their idea. For primary school students, the prototype may take the form of a simple item, model, or mock-up made from basic materials.

Testing: the completed prototypes are tested in practice. Results are evaluated by the students themselves and by other group members, and the strengths and weaknesses of each solution are identified.

Refinement (development): based on the test results, groups make adjustments to improve their prototypes; that is, students draw conclusions from their mistakes and further perfect the product.

For pre-service primary school teachers to be able to apply design thinking effectively in the lesson process, they must first gain hands-on experience testing various pedagogical projects in practice. While working on a "Making Mathematics Engaging" project, for example, students can use the design-thinking algorithm to create an interactive game or a handmade didactic tool for younger learners. In doing so, they work systematically through the stages of identifying the problem (analyzing the difficulties students encounter in mathematics), generating ideas, creating a prototype (for example, a mathematical domino game), and testing it during a lesson. As a result, not only is a practically useful product created, but pre-service teachers also develop important professional competencies: planning a lesson around a project, solving problems, applying a creative approach, and analyzing and refining their own work.

Research indicates that contextual teaching is an approach based on explaining instructional material through real-life phenomena, professional activity, or problems, its essence being to convey a topic by connecting it with situations familiar to students from everyday life[14]. When teaching addition and subtraction in primary school mathematics, for example, rather than relying solely on abstract examples, a teacher can organize the lesson around real-life situations such as a shopping scenario, in which students perform addition and subtraction operations directly while selecting goods and paying for them. As a result,

[14]Yarmatov R.B., Akramova Z.B. Mechanisms for developing the professional competencies of pre-service primary school teachers through emotional intelligence. Promising Research in Education, 2025, no. 4, part 2, pp. 193–197. (in Uzbek).

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students grasp mathematical concepts more easily and more deeply through real-life context, which enhances the practical significance of the knowledge and reinforces its retention.

Contextual teaching is especially important within STEAM technology, since integrative projects are, in most cases, aimed at solving real-life problems. Its didactic advantages are reflected in increased student interest, the transfer of knowledge (its application beyond the textbook or classroom to other situations), and heightened motivation and engagement.

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