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Article

Improving Scientific-Methodological Work As A Means of Increasing The Quality of Education

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Abstract: This article provides a comprehensive analysis of the theoretical and methodological foundations, practical mechanisms, and contemporary trends of enhancing scientific and methodological work as a strategic factor in improving the quality of education. Against the backdrop of reforms implemented in the Uzbek education system between 2016 and 2024, the effectiveness of scientific and methodological activities has been assessed on the basis of empirical data. The study systematises six main directions for scientific and methodological work in educational institutions, quantitatively analyses teachers' indicators of scientific activity, and examines international experience using a comparative method. The educational models of leading countries such as Finland, South Korea, Singapore and Kazakhstan were analysed, and recommendations tailored to the Uzbek context were developed. The main findings show that in educational institutions where scientific and methodological activities are well-organised, the average attainment of pupils and students increased by 18.4 per cent, Analysis of the experimental schools confirmed that the professional competence of teachers was 26.3 per cent higher. The 206 per cent increase in the number of Scopus and Web of Science articles in Uzbekistan between 2019 and 2024 was assessed as a positive outcome of the education-science integration policy. The article is of practical importance to the heads of educational institutions, methodologists, teacher-researchers, and education policy-making bodies.

Keywords: Quality of education, scientific and methodological work, pedagogical competence, innovative education, methodology, educational reforms, professional development, teaching and methodological support, educational monitoring, international experience.

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1. Introduction

In a modern knowledge society, the quality of the education system is becoming increasingly important as the foundation for national economic and social development. Recent research by international organisations such as UNESCO, the Organisation for Economic Co-operation and Development, and the World Bank indicates that, In determining the quality of education, pedagogical competence and the level of pedagogical and methodological support are decisive factors, rather than classroom equipment or the amount of financial resources. From this perspective, the issue of improving pedagogical support has become a central challenge in global education policy [1].

The comprehensive reforms in the field of education in the Republic of Uzbekistan, which have been implemented since 2016 – the new edition of the Law "On Education" , the National Education Concept, The "New Uzbekistan" Strategy and the "Uzbekistan – 2030" Development Strategy set raising quality as a priority task at all levels of education. The increase in the coverage of higher education from 9 per cent to 38 per cent, the rapid

introduction of digital education in schools, and the reform of the teacher training system are aimed at raising the education system to a new qualitative level [2].

However, quantitative expansion alone is not sufficient to ensure quality growth. For a genuine transformation of educational quality, it is essential to establish an institutional mechanism for scientific and methodological work, to involve educators in research activities, and to ensure that teaching and methodological support meet modern standards. In this context, clarifying the scope and content of the concept of scientific and methodological work, and scientifically studying its mechanisms of influence on the quality of education, has become an urgent task.

Research objective: to examine the impact of enhancing scientific and methodological work on the quality of education and to develop practical mechanisms and an implementation model.

Research tasks:

a. To present the main structural elements of scientific-methodological work in a systematic manner;
b. To empirically assess the current state and dynamics of scientific-methodological activity in the education system of uzbekistan;
c. Conduct a comparative analysis with international education systems;
d. Propose an effective model for stimulating scientific-methodological activity;
e. Develop recommendations for improving the education quality monitoring system.

Research hypothesis: Systematically improving scientific and methodological work significantly increases pupil/student achievement in an educational institution, and this increase is observed independently of other factors [3].

Literature Review

The concept of educational quality is regarded in the scholarly literature as a multifaceted notion. Harvey and Green explain quality in five different ways – fit, excellence, usefulness, return on investment and transformation – and in the educational context prioritise the concept of 'transformational quality.' According to this approach, the quality of education is measured by the change in the learner – the development of knowledge, skills, values and attitudes. In her seminal work, Darling-Hammond examined the impact of teacher quality on educational outcomes and empirically demonstrated that teacher practice accounts for more than 30 per cent of the variance in pupil achievement.

Pedagogical content knowledge is a multifaceted concept in pedagogy, which Shulman theorised through his concept of "Pedagogical Content Knowledge" (PCK). PCK refers to a teacher's integration of scientific knowledge of their subject with its teaching methodology. From this perspective, scholarly-methodological work is a synthesis of the teacher's scholarly research in their subject area and the process of applying the results of this research to pedagogical practice [4].

Steiner-Khamsi and Waldow, having studied international education reforms, showed that successful education systems are those that have effectively established the 'research-practice' cycle. In Finland, research by Darling-Hammond found that school teachers dedicating 30% of their time to professional development increased pupil achievement by an average of 23 per cent. This finding demonstrated that linking pedagogical research with practical teaching ensures synergistic effectiveness [5].

In the scientific literature, various approaches to the composition of scholarly-methodological work exist. Based on high scientific reliability classifications, six main blocks of this activity are distinguished:

pedagogical and methodological support (programmes, manuals, syllabuses);

a. Scientific research activity (articles, monographs, patents);
b. Innovative pedagogical technologies (stem, pbl, flipped classroom);
c. Professional development and skills enhancement;
d. Monitoring, evaluation and feedback system;

international cooperation and integration. Each block must be measured by its own specific indicators and must impact the quality of education through specific mechanisms [6].

In Uzbekistan's educational science, Musayev and Yuldoshev have developed criteria for evaluating teachers' scientific and methodological activities and proposed a three-tiered system – institutional, regional and national. Kadirov and Hasanov studied the digital transformation of scientific and methodological work in higher education and found that using LMS platforms increases teacher–student collaboration by 34 per cent.

According to PISA (Programme for International Student Assessment) results, the countries with the highest educational indicators in the world are Finland, Singapore, South Korea and Japan – are distinguished by one common feature: in all of them, teacher research and development is supported through institutional mechanisms. In Singapore, following the model of the National Institute of Education (NIE), all teachers are allocated 100 hours a year for teaching and 80 hours for research. This system is a key factor in keeping Singapore consistently in the top three in the PISA rankings. [7].

The experience of Kazakhstan is particularly relevant for Uzbekistan, as the Nazarbayev Intellectual Schools (NIS) network combines the scientific and methodological activities of its school teachers with mandatory accreditation, managed to increase PISA results by 14 points between 2019 and 2022. It is recommended that this model be adapted and applied in Uzbekistan for specialised schools (Presidential schools, STEM schools) [8].

2. Materials and Methods

A mixed methods approach was used in the research: quantitative analysis (statistical data, experimental results) and qualitative analysis (document analysis, expert interview) were combined. The research was conducted from 2021 to 2024. The main sources of data were the official statistics of the Ministry of Public Education and the Ministry of Higher and Secondary Specialised Education of the Republic of Uzbekistan; educational indicators from UNESCO, the Organisation for Economic Co-operation and Development, and the World Bank; statistics on scientific publications by Uzbek authors from the Scopus and Web of Science databases; A survey of educators (487 respondents) conducted in 12 pilot schools and 8 higher education institutions; comparative analysis with 6 control schools and 4 control higher education institutions.

As part of the experiment conducted from September 2022 to May 2024, the following research was carried out in 12 experimental and 6 control schools:

In the experimental schools, the activities of the scientific-pedagogical council were systematically intensified, with the introduction of a monthly scientific seminar, quarterly updates of teaching manuals and an annual innovative lesson festival;

In the control schools, the previous system – an annual methodological meeting and a five-year professional development course – was retained;

Pupil attainment, teacher professional development and the quality of the teaching process were assessed using instruments measuring every six months. SPSS 26.0 was used for statistical analysis; the Student's t-test for independent groups and analysis of variance (ANOVA) were employed; a p-value of < 0.05 was considered significant.

A system of the following indicators was used for the comprehensive assessment of educational quality:

Cognitive indicators – grade point average (GPA), Olympiad victories, results of standardised tests (DTS);

Pedagogical activity indicators – number of scientific publications, assessment results, proportion of innovative lessons, frequency of professional development;

Institutional indicators – the rate of updating teaching and methodological documents, the index of digital resource utilisation, the number of international cooperation projects;

Contextual indicators – student satisfaction survey, parents' satisfaction index. Each indicator has a quantitative measure in the evaluation methodology, and the results were re-measured at 3, 6 and 12-month intervals.

3. Results and Discussion

Based on the research findings, a system of six strategic directions for scientific and methodological work in an educational institution and their evaluation indicators was systematised [9]:

Table 1. Main directions of scientific and methodological work in educational institutions.

Direction	Main Types of Activities	Expected Result	Evaluation Indicator
Educational and Methodological Support	Curricula, manuals, syllabi	Availability of modern educational materials	Compliance with updated State Educational Standards (%)
Scientific Research Activity	Articles, monographs, grants	Number of scientific publications and citations	Number of Scopus/WoS indexed articles
Innovative Pedagogical Technologies	Problem-based learning, project-based learning, flipped classroom	Increase in student engagement	Growth in PISA and TIMSS results
Professional Development and Certification	Trainings, webinars, seminars	Improvement of pedagogical competence	Certification results (%)
Monitoring and Quality Control	Lesson analysis, portfolio, rating system	Continuous improvement of education quality	Average score and GPA dynamics
International Cooperation and Integration	Academic mobility, joint projects	Adaptation to global educational trends	Position in international rankings and indices

Table 1 shows that scientific and methodological work is a multifaceted activity, with each direction having its own distinct and measurable criteria. In practice, most educational institutions focus on the first direction (pedagogical and methodological support), while failing to sufficiently develop the other five directions. This imbalance has been identified as a key barrier to the systematic improvement of educational quality [10].

A statistical analysis of the Uzbek education system for 2019–2024 showed a significant positive dynamic [11].

Table 2. Indicators of the quality of education and scientific and methodological activity in Uzbekistan (2019–2024).

Indicator	2019	2020	2022	2024	Growth %

Number of Higher Education Institutions	112	135	167	195	+74.1
Higher Education Coverage (%)	9.0	16.5	28.4	38.0	+29
Number of Scopus Articles	1,840	2,210	3,870	5,640	+206
Certified Teachers (%)	68.4	71.2	78.9	84.7	+16.3
Schools Using Digital Resources (%)	34.7	41.3	63.8	78.4	+43.7
Participants in International Olympiads (persons)	124	98	187	243	+96.0
Education Expenditures (billion UZS)	24,780	31,420	52,340	87,650	+253.7

The most important conclusion of Table 2 is that the 206 per cent increase in the number of Scopus and WoS articles (from 1,840 to 5,640) is regarded as a significant outcome of the education–science integration policy. This growth demonstrates the integration of educators and scientists into the international scientific arena, signifying a success in enhancing scientific and methodological work. The rise in the proportion of schools using digital resources from 34.7 per cent to 78.4 per cent confirms the rapid pace of digital transformation. The increase in the proportion of teachers who have passed attestation from 68.4 per cent to 84.7 per cent demonstrates the effectiveness of the professional development system reforms [12].

The comparative evaluation of pilot and control institutions made it possible to analyse the effectiveness of the scientific and methodological work at three levels [13]:

Table 3. Efficiency levels and evaluation criteria of scientific and methodological work.

Criterion	Low Level	Medium Level	High Level	Assessment Tool
Quality of Educational and Methodological Documents	Outdated, not compliant with standards	Partially updated	Fully compliant with State Educational Standards and digitalized	Expert evaluation, audit
Scientific Activity of Teachers	No articles, limited exchange of experience	Presence of local publications	Scopus/WoS publications, grants, patents	h-index, citation analysis
Use of Innovative Methods	Only traditional lectures	Occasional problem-based learning	STEM, PBL, flipped classroom, digital technologies	Lesson observation protocol

Regularity of Professional Development	Less frequent than every 5 years	Once every 5 years	Every 1–2 years, including international programs	Certificates, attestation
Monitoring and Evaluation System	Annual reports only	Semi-annual monitoring	Real-time monitoring, portfolio system	Platforms (Moodle, LMS)
Student Performance	Average score < 60	Average score 60–74	Average score ≥ 75	Rating system, GPA, olympiads

The results in Table 3 show that pupils in educational institutions that have met the 'high level' criteria have an average score of 75 points or above. In the experimental study, the average score in the 12 experimental schools increased by 18.4 per cent compared with the previous academic year, whereas in the six control schools it rose by only 3.2 per cent ($p<0.001$). This difference statistically confirms that the systematic improvement of pedagogical and methodological work has an independent and significant impact on the quality of education, fully proving the research hypothesis [14].

The indicators of pedagogical scientific and methodological activity among educators in the experimental and control institutions are presented in the following table [15]:

Table 4. Evaluation of teachers' scientific and methodological activity: comparison of experimental and control institutions.

Type of Activity	Score (for 1 activity)	Maximum Score	Annual Average (Experimental School)	Annual Average (Control School)	Difference
Scopus/WoS Article	15 points	45	2.4	0.3	+2.1
Article in a Local Journal	5 points	25	3.8	1.2	+2.6
Educational Manual (Author)	10 points	20	0.8	0.2	+0.6
Innovative Lesson (Approved)	3 points	15	4.2	1.7	+2.5
Participation/Organization of Training	2 points	10	3.6	1.4	+2.2
Total Annual Average	–	115	62.4	18.7	+43.7

The results of Table 4 – an average annual score of 62.4 points in the experimental institutions (control group 18.7 points, difference +43.7 points) – proved the decisive role of the system for stimulating scientific and methodological activity. It is noteworthy that the largest difference in Scopus/WoS articles (+2.1) was on a par with the difference in the application of innovative methods (+2.5), indicating that theoretical research and practical innovation reinforce each other and generate synergy. In control schools, the average

Scopus article indicator was an extremely low 0.3, indicating that achieving international scientific publication has not yet become a widespread practice in our region [16].

A comparative analysis with leading education systems provided the basis for creating a hybrid model tailored to Uzbekistan [17]:

Table 5. International education systems and their applicability to Uzbekistan.

Country	Main Model	Teachers' Scientific Workload	PISA / QS Ranking	Applicability for Uzbekistan
Finland	Autonomy + research	20% of working time devoted to research	PISA Top-5	Strengthening the integration of teacher autonomy and research activities
South Korea	Centralized + innovation	Minimum 1 article per year	PISA Top-7	Introducing state support and quota systems
Singapore	NIE model (theory + practice)	100 hours/year teaching + 80 hours research	QS Top-3	Strengthening the teacher college system
Kazakhstan	NIS system (Nazarbayev Intellectual Schools)	Annual certification	PISA +14 points (2019–2022)	Establishing pilot schools in Uzbekistan based on the Nazarbayev model
Uzbekistan (2024)	Reform stage	Professional development every 5 years	PISA participation in 2025	A hybrid system adapted from the above models is recommended

Analysis of Table 5 compares the models of Finland, South Korea, Singapore and Kazakhstan, and establishes the foundations of a hybrid model for Uzbekistan. Kazakhstan's experience, owing to its geographical, cultural and systemic proximity, is the most directly applicable. The Singapore model, on the other hand, could serve as a long-term strategic benchmark as the system delivering the highest-quality outcomes [18].

Based on the generalisation of the research findings, a five-step systematic model for improving scientific and methodological work in the Uzbekistan education system is proposed:

Stage 1 – Diagnosis and monitoring (0–3 months). Assessing the state of scientific and methodological work in each educational institution; drawing up a map of teachers' scientific activity; identifying weaknesses. Main tool: self-assessment questionnaire and external audit.

Stage 2 – Strategic Planning (1–2 quarters). Approving the institution's scientific and methodological work strategy; allocating resources (financial, time, infrastructure); setting target indicators. Key document: 3-year scientific and methodological development plan.

Stage 3 – Implementation and monitoring (2–3 years). Organisation of scientific seminars, methodological days, and innovative lesson festivals; updating teaching and methodological documents in accordance with the DTS; methodological support for teachers in writing scientific articles. Main platform: the institution's scientific and methodological council [19].

Stage 4 – Incentivisation and motivation (ongoing). Material and moral incentives for academically active pedagogues; bonuses for scientific and methodological indicators; a professional development roadmap. Main mechanism: a points-based rating system.

Stage 5 – Systematisation and dissemination of results (annual). Publication of scientific conferences and collections; annual report on the achievement of target indicators; dissemination of experience to other institutions. Main format: scientific methodological collection and webinar.

The study identified the main factors hindering the improvement of scientific and methodological work:

a. Limited time resources – teachers' teaching load of 18–24 hours per week leaves no time for scientific work. Solution: reduce classroom teaching time by 10–15 per cent and redirect it to research (the Finnish experience).
b. Weak material incentives – writing a scientific article does not guarantee additional pay. Solution: introduce a one-off award of one to two months' salary for each Scopus article.
c. Lack of scientific writing skills – most educators are unfamiliar with the methodology for preparing international articles. Solution: Make the "Scientific Writing" module compulsory at Teacher Training Institutions (UMOI).
d. Inequitable digital infrastructure – 38.4 per cent of rural schools lack high-speed internet. Solution: The Ministry should complete the "Digitalise Schools" programme by 2026 [20].

4. Conclusion

This study empirically demonstrated the strategic role of scientific and methodological work in improving the quality of education, and reached the following key conclusions.

Firstly, the systematic improvement of scientific and methodological work increases the average student attainment in an educational institution by 18.4 per cent (difference between the experimental and control groups, $p < 0.001$). This result fully confirms the research hypothesis: scientific and methodological activity has a statistically significant, independent, and practically significant impact on the quality of education.

Secondly, The 206 per cent increase in the number of Scopus/WoS articles in Uzbekistan from 2019 to 2024, the accelerated pace of digitalisation in schools, and the rise in the share of certified educators to 84.7 per cent indicate the positive outcome of the reforms. However, the unresolved issues – a shortage of time resources, scientific writing skills, and weak infrastructure in rural schools – indicate that there is ample room for improvement.

Thirdly, international experience – Finland, Singapore, South Korea, Kazakhstan – shows that all leading education systems support the pedagogical scientific activity of teachers through institutional mechanisms. For Uzbekistan, a hybrid model adapted from the Kazakhstani NIS model and the Singaporean NIE system was identified as the most suitable approach.

Theoretical significance: the study has presented a new conceptual model classifying six strategic directions of scientific and methodological work and their mechanisms of influence on the quality of education. Practical significance: a five-stage systemic model and a quantitative system for assessing teachers' scientific activity have been developed as practical tools directly applicable to educational institutions.

Recommendations for the heads of educational institutions and methodologists:

a. Organise the activities of the scientific-methodological council in each educational institution on a monthly basis;
b. Include the annual scientific-methodological work plan of teachers in the accreditation requirements;
c. Develop a quantitative system for assessing the scientific activity of teachers;
d. Implement a material incentive mechanism for articles in Scopus/wos;
e. Develop digital LMS platforms (Moodle, Google
f. Introduce a financial incentive mechanism for Scopus/WoS articles;

update teaching and methodological documents in real time using digital LMS platforms (Moodle, Google Classroom, the Uzbekistan LMS). Future research directions: the impact of artificial intelligence technologies on scholarly and methodological work; the impact of a teacher's scientific activity on long-term (10-year) educational outcomes; studying models for the participation of Uzbekistan's schools in international joint research projects.

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