

**PROBLEMS AND THE CURRENT STATE OF METHODOLOGICAL
PREPAREDNESS OF FUTURE TEACHERS****Atenov Jandarbek Dayrabay ugli**

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Annotatsiya

Maqolada bo'lajak pedagoglarni tayyorlash jarayonida STEAM (Science, Technology, Engineering, Art, Mathematics) yondashuvining ahamiyati, pedagogik kompetensiyalarni shakllantirish va innovatsion metodlarni qo'llash imkoniyatlari tahlil qilinadi. STEAM yondashuvi orqali talabalar ijodiy fikrlash, muammolarni hal qilish va amaliy ko'nikmalarni rivojlantiradi. Tadqiqot natijalari STEAM ta'limi bo'lajak pedagoglarni zamonaviy ta'lim muhitiga tayyorlashda samarali ekanini ko'rsatadi.

Kalit so'zlar

STEAM ta'limi, pedagogik ta'lim, innovatsion metodlar, integrativ ta'lim, kreativ fikrlash, kasbiy kompetensiya.

Abstract

The article analyzes the importance of the STEAM (Science, Technology, Engineering, Art, Mathematics) approach in the process of training future teachers, the possibilities of forming pedagogical competencies and applying innovative methods. Through the STEAM approach, students develop creative thinking, problem solving and practical skills. The results of the study show that STEAM education is effective in preparing future teachers for a modern educational environment.

Аннотация

В статье анализируется важность подхода STEAM (наука, технология, инженерия, искусство, математика) в процессе подготовки будущих учителей, возможности формирования педагогических компетенций и применения инновационных методов. Благодаря подходу STEAM учащиеся развивают творческое мышление, навыки решения проблем и практические умения. Результаты исследования показывают, что STEAM-образование эффективно готовит будущих учителей к современной образовательной среде.

Ключевые слова

STEAM-образование, педагогическое образование, инновационные методы, интегративное образование, творческое мышление, профессиональная компетентность.

Keywords

STEAM education, pedagogical education, innovative methods, integrative education, creative thinking, professional competence.

The methodological preparedness of future teachers is considered one of the most important directions in the modern education system. Methodological preparedness is

understood as a complex of knowledge, skills, personal and professional qualities necessary for a teacher to successfully carry out professional activities. It consists of three main components:

1. **Theoretical preparation** – deep mastery of pedagogy, psychology, teaching methods, and educational theory.
2. **Practical preparation** – the ability to teach, develop instructional materials, and apply interactive and innovative teaching methods.
3. **Personal-pedagogical qualities** – creativity, communicative competence, and adherence to pedagogical ethics.

Methodological preparedness ensures the effectiveness of teachers as professionals and enables them to successfully manage the educational process. Therefore, special attention should be paid to the development of this process. Currently, the system of preparing future teachers in higher education institutions in Uzbekistan mainly relies on theoretical knowledge. Although this theoretical orientation plays an important role in developing pedagogical knowledge and methodological skills, in many cases it remains limited to knowledge transmission. Students studying pedagogy and teaching methodology should have opportunities to apply their theoretical knowledge in practical activities. However, such opportunities are often insufficient in the current system, which hinders the full development of teachers' methodological preparedness and professional competencies.

The curricula of higher education institutions primarily focus on providing scientifically grounded pedagogical knowledge. Students acquire extensive theoretical knowledge in pedagogy, psychology, and methodological disciplines. These theoretical foundations contribute to the development of scientific thinking, deep understanding of pedagogical concepts, and the ability to analyze educational processes. However, this theoretical advantage is not sufficiently connected with practical experience. For instance, students may understand teaching technologies or interactive methods theoretically but have limited opportunities to apply them in real classroom settings. As a result, the practical implementation of theoretical knowledge remains insufficient, and the development of pedagogical competencies becomes only partially effective.

Practical pedagogical training is one of the most essential components for future teachers, as it develops skills such as lesson planning, applying interactive methods, and classroom management. Currently, pedagogical practice in many universities is short-term and limited in scope. For example, in some institutions students participate in practice only for a few weeks or months, which does not allow them to gain sufficient pedagogical experience. The lack of practical training restricts the development of independent teaching skills, the ability to make quick decisions in real pedagogical situations, and the capacity to implement innovative approaches.

In modern education, pedagogical training is based not only on theoretical and practical knowledge but also on readiness to apply innovative methods. In this regard, interactive teaching strategies, digital technologies, and the STEAM approach play an important role in improving the quality of education. However, in many higher education institutions these methods have not yet been sufficiently integrated. Consequently, future teachers do not acquire adequate skills in applying innovative pedagogical approaches, technological tools, and interdisciplinary STEAM projects in the educational process.

The above circumstances indicate that the methodological preparedness of teachers in the higher education system of Uzbekistan remains unevenly developed. The dominance of



theoretical knowledge limits the development of practical skills, short-term and restricted pedagogical practice hinders the formation of professional experience, and insufficient use of innovative methods complicates the adaptation of teachers to modern educational standards. Therefore, improving pedagogical training through the integration of theoretical knowledge, practical training, and innovative methodologies has become a pressing issue.

The **STEAM (Science, Technology, Engineering, Arts, Mathematics)** approach is described as an innovative pedagogical methodology aimed at developing creative and problem-solving thinking through interdisciplinary integration in education. This approach contributes to the development of competencies such as problem solving, teamwork, creativity, and critical thinking by integrating fundamental scientific knowledge with elements of technology and arts.

The success of STEAM education largely depends on teachers' competencies. International studies show that although teachers may understand this approach theoretically, they often lack sufficient preparation to effectively implement it in practice. For instance, teachers frequently face difficulties in integrating subjects, implementing project-based learning, or guiding students through problem-based tasks. One of the main reasons for this is the absence of structured and systematic training programs within STEAM pedagogy.

This situation leads to several consequences:

- Teachers feel uncertain about planning and assessing STEAM projects.
- They cannot fully understand the essence of interdisciplinary integration, which results in fragmented approaches in classroom practice.

The effective implementation of the STEAM concept requires practical resources, technological equipment, and an innovative learning environment. However, many educational institutions face several limitations:

- **Lack of laboratory equipment and interactive tools** – devices such as 3D printers, touchscreen technologies, and robotics kits are insufficient.
- **Limited digital platforms and educational simulations** – students have few opportunities to test theoretical knowledge in practical environments.

These limitations complicate the planning and implementation of STEAM projects and slow down the development of students' problem-solving abilities and technological skills.

The essence of the STEAM approach lies in breaking the boundaries of traditional disciplines and creating a hybrid knowledge environment through their integration. However, current curricula often do not sufficiently reflect interdisciplinary connections. This leads to several problems:

1. **Lack of interdisciplinary project planning** – each subject is taught separately, with little attention to integration.
2. **Inconsistency between learning materials** – students cannot effectively apply knowledge gained in one subject within the context of another.

For example, the integration of mathematics and engineering knowledge enables students to develop analytical and technological thinking necessary for solving complex real-life problems. However, such integration is insufficiently implemented in traditional educational programs.

In traditional education systems, assessment is usually conducted through tests or written examinations. In contrast, STEAM emphasizes project-based outcomes, creativity, and problem-solving tasks. This creates a mismatch between the two assessment approaches:

- In STEAM projects, students are evaluated through project portfolios, creative products, or presentations, which require deeper competency analysis.
- Traditional assessment systems focus mainly on factual knowledge.

As a result, difficulties arise in evaluating students' achievements within STEAM processes because existing assessment systems cannot accurately measure the competencies being developed.

One example of successful implementation of the STEAM approach is interdisciplinary project-based lessons. For instance, experimental lessons incorporating STEAM elements have been conducted in several primary schools in Tashkent, where students demonstrated significant improvement in critical thinking, problem-solving, and collaborative skills.

Furthermore, project-based activities organized in mathematics classes using STEAM technologies have been shown to enhance students' analytical thinking and creativity.

To address these challenges, the following strategies are recommended:

- **Specialized pedagogical training and professional development programs:** Teachers should be trained deeply in the STEAM approach, including learning new methodologies, designing project-based lessons, and developing appropriate assessment strategies.
- **Equipping innovative laboratories and resources:** Educational institutions should provide technological tools, laboratories, and digital platforms to enable both teachers and students to gain practical experience.
- **Updating curricula and strengthening integrative approaches:** Textbooks and curricula should be redesigned to incorporate interdisciplinary connections and fully integrate the STEAM concept into the educational process.
- **Modernizing the assessment system:** Rubrics and evaluation frameworks based on portfolios, project outcomes, and competency development should be introduced to assess STEAM projects effectively.

Within the existing curricula of pedagogical faculties in Uzbekistan's higher education institutions:

- The **set of methodological disciplines is sufficient**, as pedagogical theories and methods are included in the curricula.

- **Practical training and project-based work remain limited**, and students do not have enough opportunities to plan and conduct their own lessons.
- **Digital and interactive resources are insufficient**, and electronic educational tools remain limited.
- **STEAM integration is weak**, as many programs focus mainly on theoretical knowledge, while interdisciplinary projects are rarely implemented.

The analysis shows that modernization of curricula and strengthening methodological support are essential for the effective development of teachers' methodological preparedness.

Currently, the methodological preparedness of future teachers faces several challenges: theoretical knowledge is sufficient, but practical skills and innovative methods are underdeveloped. The STEAM approach may serve as an important tool to address these problems; however, its successful implementation depends on resources, teacher preparation, and program integration. Therefore, higher education institutions should widely introduce modern curricula, interactive methodological support, and STEAM-based projects to enhance the methodological preparedness of teachers.

Adabiyotlar

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