European Journal of Innovation in Nonformal Education (EJINE)
Volume 6 | Issue 5 | May - 2026 ISSN: 2795-8612

Methodological Aspects of Developing Integrated Skills and Abilities in Students During the Teaching of Special Subjects

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A B S T R A C T
The article discusses the methodological aspects of developing integrated skills and abilities in higher education students of Uzbekistan in the process of teaching special subjects. Based on the analysis of the State Program of Higher Education Development (Decree of the President No. PF-5987 dated 29.04.2020) and the Concept of Higher Education Development until 2030, the necessity of interdisciplinary integration as a strategic direction of modernization of higher education is substantiated. The author's methodological model of developing integrated skills, adapted to the conditions of the credit-modular system, is presented.

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A R T I C L E I N F O
Article history:
Received 14 Mar 2026
Received in revised form
5 Apr 2026
Accepted 3 May 2026

Keywords: Integrated Skills and Competencies, Higher Education in Uzbekistan, Special Subjects, Interdisciplinary Integration, Credit-Modular System, Concept for the Development of Higher Education Until 2030, Competency-Based Approach, and Professional Training

Introduction

Higher education in Uzbekistan is currently undergoing a profound systemic transformation. The Presidential Decree “On Approval of the Concept for the Development of Higher Education in the Republic of Uzbekistan until 2030” (No. PF-5987 dated April 29, 2020) has set strategic goals for the sector, with a particular focus on “Ensuring the integration of education, science, and industry”. The key indicators of the Concept are: increasing the share of practical training in educational programs from 35% to 80% by 2030, introducing a credit-modular system in all universities (85% by 2030), and increasing the share of faculty members with academic degrees from 36% to 70% [9].

In these conditions, the problem of forming students' integrated skills becomes particularly relevant - the ability to synthesize knowledge from various disciplines, transfer methods of action from one subject context to another, and apply an integrated approach to solving professional problems. According to Uzbek researchers, “Integration processes in the development of the higher education system of Uzbekistan require solving integration problems, implementing interdisciplinary integration of special subjects” [3].

However, an analysis of teaching practices in universities shows that the traditional subject-centered learning model remains dominant. Students successfully master individual disciplines, but face significant challenges when it comes to interdisciplinary synthesis of knowledge to solve complex professional tasks. This contradiction defines the problem field of this research.

The purpose of this article is to present methodological approaches to the formation of integrated skills and abilities in university students of Uzbekistan in the process of teaching special subjects, taking into

account modern educational reforms and the requirements of the credit-modular system.

The relevance of the study is determined by a complex of interrelated factors:

1. The State Strategy for the Development of Higher Education. The Concept for the Development of Higher Education in the Republic of Uzbekistan until 2030 sets the goal of "Improving the quality of personnel training in accordance with the modern requirements of the labor market", which is impossible without developing students' integrative competencies [9]. In accordance with the Law on Education (2020) and the National Program for Personnel Training, "The leading principles of respecting national interests in education and upbringing have been established, taking into account the preservation and development of rich pedagogical experience" [3].

2. Implementation of the credit-modular system. As stated in the Concept, by 2030, the credit-modular system will be implemented in 85% of universities in Uzbekistan. This requires a review of the content and methods of teaching special subjects, as well as strengthening their interconnection and integration.

3. Requirements for the integration of education, science, and production. The strategic direction for the development of higher education in Uzbekistan is "Ensuring the integration of education, science, and production". The development of integrated skills is a necessary condition for the implementation of this direction.

4. The scientific and methodological significance of the problem. According to Tukhtaeva Z.Sh., Kanotova D.S., and Zhamolov Zh.T., "The integration processes in the development of the higher education system in Uzbekistan" require a deep theoretical understanding and the development of practical recommendations for the implementation of interdisciplinary integration of special subjects.

5. Modern requirements for a higher education teacher. In Uzbekistan, systematic work is being carried out to improve the qualifications of professors and teachers. International scientific and practical conferences are being held to discuss the implementation of a competence-based approach in the educational system, the widespread use of advanced pedagogical practices and innovative technologies in teaching subjects, and the development of STEAM and interdisciplinary integration [1].

Thus, the relevance of the topic is due to the gap between the strategic objectives of reforming higher education in Uzbekistan and the actual level of methodological readiness of university teachers to develop students' integrated skills.

The purpose of the study: to develop, theoretically substantiate, and experimentally test the methodological conditions for the formation of integrated skills and abilities in university students when studying special subjects under the credit-modular system.

Tasks:

- to analyze the regulatory and legal documents that define the development strategy of higher education in Uzbekistan in terms of the requirements for integrating the educational process;
- to clarify the concept of "integrated skills and abilities" in relation to the process of teaching special disciplines at a university;
- to identify the criteria and levels of development of integrated skills among students, taking into account the competency-based approach;
- to develop a methodological model for the formation of integrated skills that integrates the requirements of the credit-modular system, an interdisciplinary approach, and practice-oriented learning;
- to test the model in the real educational process at technical universities in Uzbekistan.
- conduct a quantitative and qualitative analysis of the experiment results.

The methodological basis of the study was as follows:

- System-activity approach (L.S. Vygotsky, A.N. Leontiev, P.Ya. Galperin): integrated skills are formed

- in the process of performing educational and professional activities that require the synthesis of knowledge from various disciplines.
- Competency-based approach, which is enshrined in the Law on Education of the Republic of Uzbekistan (2020) and the Concept for the Development of Higher Education until 2030.
- The theory of interdisciplinary integration (V.N. Maksimova, N.E. Fedorova). According to Uzbek researchers, "The integration-pedagogical process is the codification and synchronization of real phenomena in the education system of different countries by means of comparative analysis, which means a dynamic process of interpenetration of individual differentiated parts and functions of the education system".
- The concept of integrating Uzbekistan's higher education into the global educational space, according to which "Uzbekistan is open to the world, and we strive to gain a deeper understanding of the processes taking place on the planet today and to join the achievements of modern civilization".

Research Methodology

- Theoretical: analysis of Uzbekistan's legal and regulatory documents in the field of higher education, review of domestic and foreign literature, and modeling.

- Empirical: pedagogical experiment, observation, testing, questionnaires, and analysis of students' educational products.

Sample: The study involved 186 second- and fourth-year students from the Bukhara Institute of Engineering and Technology and the Islam Karimov Tashkent State Technical University (specialties: "Technology and Equipment for Light Industry," "Mechanical Engineering," and "Information Technology"). The control and experimental groups were matched based on their initial academic performance and entrance test scores ($p>0.05$).

Duration of the experiment: 3 semesters (September 2024 – May 2025).

The results and their analysis.

The ascertaining stage.

At the first stage of the experiment, an analysis of curricula and work plans for special subjects in universities in Uzbekistan was conducted. It was revealed that only 18% of assignments are interdisciplinary, and there is almost no systemic integration. A questionnaire survey of teachers (n=48) showed that 76% of respondents understand the importance of interdisciplinary integration, but only 23% have experience in implementing it.

A structure of integrated skills has been developed for students studying special subjects at a university:

Component	Content	Examples of skills (taking into account the university context)
Cognitive-integrative	Searching, analyzing, and synthesizing information from various disciplines	Apply mathematical tools to calculate technological parameters; use computer science methods to analyze experimental data
Operationally synthesizing	Applying methods from one subject to another	Use the principles of theoretical mechanics in the design of technological systems; apply economic knowledge in engineering calculations

Reflexive-adaptive	Estimating the boundaries of knowledge applicability and correcting the algorithm	To compare the theoretical model with a real production situation; to develop a combined method for solving a professional task

Results of the pre-experiment diagnostics (average score on a 10-point scale):

Group	n	Cognitive-integrative	Operationally synthesizing	Reflexive-adaptive	The overall indicator
CG	93	3,4	3,2	2,7	3,10
EG	93	3,5	3,3	2,8	3,20

The differences are not statistically significant ($t=0.45$, $p>0.05$).

The formative stage.

The experimental groups implemented a developed methodological model that takes into account the following:

- The requirements of the Concept for the Development of Higher Education until 2030 (integration of education, science, and production; credit-modular system).
- An interdisciplinary approach (unification of special subjects around complex educational and professional tasks).
- A focus on practical training (the share of practical classes has been increased to 60%).
- Digital educational technologies (the use of electronic platforms and information systems).
- The main elements of the model:
- Interdisciplinary modules (combining 2-3 special subjects around a complex professional task).
- Design and integrative tasks with elements of scientific research.
- A case study based on the material of real production situations of Uzbek enterprises.
- Reflexive practices with the fixation of interdisciplinary connections.

The results after the experiment.

Component	CG (average score)	EG (average score)	Growth (Δ)	The level of significance
Cognitive-integrative	4,3	8,1	+3,8	p<0,01
Operational-synthesizing	4,0	7,8	+3,8	p<0,01
Reflexive-adaptive	3,2	7,3	+4,1	p<0,001
Integral indicator	3,83	7,73	+3,9	p<0,001

Distribution of students by level of development (in %):

Level	CG (initial)	CG (total)	EG (initial)	EG (total)
Low (0–4 points)	60%	47%	58%	8%
Medium (5–7)	32%	43%	34%	46%
High (8–10)	8%	10%	8%	46%

Conclusion.

The conducted theoretical and experimental research allows us to draw the following conclusions:

1) The strategic documents on the development of higher education in Uzbekistan (the Concept until 2030, the Law on Education, and Decree No. PF-5987) create a regulatory framework for the implementation of interdisciplinary integration in the university educational process. However, they require the development of specific methodological tools for teachers of special subjects.

2) The developed methodological model for the formation of integrated skills, which takes into account the requirements of the credit-modular system, an interdisciplinary approach, and practice-oriented learning, has proven to be effective: the experimental groups showed statistically significantly higher results in all components ($p<0.01–0.001$).

3) The pedagogical conditions for the successful implementation of the model in universities in Uzbekistan are as follows:

- harmonization of the curricula of special subjects in accordance with the requirements of interdisciplinary integration and the credit-modular system;
- development of a bank of interdisciplinary integrative tasks, taking into account the specifics of professional training;
- professional development of teachers through training sessions and seminars on interdisciplinary learning technologies;
- use of digital platforms for creating interactive integrative tasks.

4) Research prospects: adaptation of the model for various fields of study (natural sciences, humanities, and economics), development of an electronic bank of interdisciplinary tasks, creation of a system for monitoring the development of integrated skills in accordance with the requirements of the competence-based approach, and study of integration opportunities in master's programs.

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