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ORGANIZING A CONVERGENT LECTURE IN PHYSICS IN AN INFORMATION-LEARNING ENVIRONMENT AT TECHNICAL HIGHER EDUCATION INSTITUTIONS

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Abstract. The article discusses the use of the convergent lecture technology in teaching physics at higher education institutions in technical fields. It also analyzes the factors that enhance interactive communication between teachers and students in an information-educational environment and increase the effectiveness of the learning process. The convergent lecture is evaluated as an important method for improving the quality of higher education.

Keywords: convergent lecture, information-educational environment, physics education, flipped learning technology, interactive collaboration, innovative pedagogy, independent learning.

Introduction. The Resolution No. 466 of the Cabinet of Ministers of the Republic of Uzbekistan, dated August 7, 2020, "On Measures to Improve the Quality of Education in the Higher Education System," established a legal framework for fundamentally renewing and developing the country's higher education system [1]. This document emphasizes the need to improve the educational process in higher education institutions in accordance with international standards, widely implement advanced pedagogical and information-communication technologies, direct students' professional competencies toward practical activities, and organize the teaching process based on innovative approaches.

At present, social and economic life is characterized by rapid changes, the modernization of daily life, and the deep informatization of society, alongside the rapid development and increasing complexity of information and communication technologies. These conditions place new demands on technical higher education institutions to qualitatively improve the training of future engineers and to develop their professional and practical competencies.

The main challenges in this area are primarily associated with the slow integration of modern information and communication technologies into the educational system, the predominance of traditional methodological approaches in organizing the educational process at higher education institutions, and the lack of a fully developed scientifically grounded concept of pedagogical interaction among the subjects involved in the educational process.

Methodology. The integration of modern information technologies with innovative pedagogical approaches provides extensive opportunities to enhance the educational process in higher education, organize learning activities in a results-oriented manner, and increase teaching effectiveness. Today, a key requirement for introducing advanced technologies into the education system is the creation of an information-learning environment and its rational use [2].

Although the formation and methodological improvement of an information-learning environment is an important factor in the educational process, it alone cannot fully ensure the effectiveness of learning. In our view, a deeper reform of the educational process is required, i.e., creating conditions in which the educational environment acts as an active tool influencing the student's personal development and promotes a higher level of self-directed learning.

The main aim of this study is to develop a methodological system for effectively organizing convergent lectures in physics within the information-learning environment of

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technical higher education institutions and to implement it in practice. Improving the educational process in higher education institutions is directly linked to the renewal of teaching paradigms within the information-learning environment. This process is based on the convergence of scientific-pedagogical knowledge and modern information technologies. Consequently, the convergent education model is gradually being integrated into higher education.

Convergence is understood as the continuous interaction and mutually enriching collaboration of sciences, technologies, social communities, and human activities. As a result, their mutual adaptation and integration occur. Consequently, the convergent approach is formed based on the interaction and interpenetration of different fields, resulting in new knowledge and experience that qualitatively differ from previous systems [3].

The essence of the convergent approach lies in the interaction and integration of various sciences and technologies, leading to the creation of new, higher-level knowledge. This knowledge system is not merely a collection of individual sources, but rather a new qualitative state arising from their interaction. Convergence in education can only occur when sciences and technologies not only overcome their boundaries but also enhance each other, elevating the quality of education to a new level [4].

Within the scope of this study, a methodological system for teaching physics was implemented in the information-learning environment of higher education institutions. In practice, integrated pedagogical technologies of blended learning were applied, including a module-rating system, the flipped classroom approach, and project-based learning elements. As a practical component, convergent lectures were developed. During these lectures, students acquired skills to understand natural laws, analyze cause-and-effect relationships between phenomena, and master theoretical concepts that broaden scientific thinking.

The blended learning model not only delivers theoretical knowledge but also develops students' abilities to analyze experimental tasks, generalize information, and draw conclusions. "Blended learning" combines traditional classroom activities with active interactive engagement in an electronic learning environment, allowing 70–80% of the educational process to be conducted online and through independent study. Classroom sessions are then optimized based on students' performance in the online platform [5].

Integrating innovative blended learning technologies—module-rating, flipped classroom, and project-based learning—with the convergent approach allows the structure of lecture sessions to be updated in accordance with modern requirements. In this study, the module-based teaching technology was chosen as the primary method, and the lecture content was structured into four functional blocks (Table 1).

Results. Dividing theoretical material into independent information blocks and presenting lectures with the help of supporting schemes, graphs, tables, and symbolic-graphic indicators simplified the learning material and facilitated visual perception [6].

Table 1. Lecture Structure in Module-Based Teaching

Actualization	**Generalization Block**	**Theoretical Block**	**Theorization Block**
Involves actualizing the problem by taking into account modern scientific materials, technologies, and	Involves summarizing students' existing knowledge, key concepts, laws, and phenomena, as well as	Involves the formation of theoretical knowledge, revealing new laws, cause-and-effect relationships,	Involves conclusions aimed at generalizing, consolidating, and deepening theoretical

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techniques.	their experimental results	and characteristics.	knowledge.

Flipped Classroom Technology

Flipped classroom technology is an innovative approach that allows the traditional lesson process to be organized in a new way, with the primary focus on students' independent learning activities [7]. In this model, the teacher does not act as a direct source of information but rather participates as a facilitator, guide, and advisor in the learning process. Utilizing the capabilities of the information-learning environment, learning materials, assignments, and assessment tools are provided electronically, enabling students to study independently outside of classroom hours.

Students familiarize themselves with lecture content independently, analyze it, identify key concepts, and assess their knowledge through interactive tests in the electronic environment. The results are incorporated into their overall performance ratings. Classroom sessions are primarily devoted to analytical discussions, practical tasks, and project-based work.

The flipped classroom model links the two components of the educational process—independent study and classroom activities. As a result of this approach, students develop self-learning skills.

Table 2. Methodology for Organizing Lectures in the Information-Learning Environment of Technical Higher Education Institutions

Students' Independent Work (in the Electronic Learning Environment)	**Classroom Activities**
Lecture materials are uploaded to the course. Assignments are given for students' independent work. Students work with the content of the learning materials and create summaries/notes. Completion of standard tests (results are included in the overall rating). Interactive exercises are carried out in the electronic learning environment. Conditions are created to prepare for the next classroom session.	**Actualization:** define the significance of the topic. **Generalization Block:** activate students' prior knowledge. **Theoretical Block:** explain new concepts, laws, and phenomena. **Theorization Block:** consolidate, systematize knowledge, and complete practical tasks. **Group Work / Creative Tasks:** perform group activities, creative assignments, and mini-projects.

Organization of Lectures in the Classroom

The lecture process conducted in the classroom is organized in two stages. During the first hour, the teacher explains the lecture content in detail: presenting problems through multimedia presentations, demonstrating illustrative experiments, identifying key concepts and laws, and

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explaining cause-and-effect relationships between phenomena [8]. Having a lecture summary available allows students, during the second hour, to deepen their understanding of complex concepts and complete analytical and creative tasks.

Classroom activities are primarily practical in nature, aimed at reinforcing the central concepts of the topic, solving applied problems, and assimilating learning material in a systematic and generalized form. The structure of lectures integrates different types of activities: topics are divided into thematic blocks, texts are segmented, and content is presented in a multimodal format. This approach enables students to process complex theoretical material through multiple "channels" – text, audio, video, and graphics. In this way, the overall content in a convergent multimedia lecture is delivered to students in a more comprehensible and visually enriched format.

Table 3. Sample Assignments for Students on Creating an "Event Passport"

Event Passport: "Fraunhofer Diffraction (Converging Rays)"	**Event Passport: "Compton Effect"**
1. Explain the concept of Fraunhofer diffraction.	1. Explain the physical meaning of the Compton effect.
2. Draw the direction of rays for diffraction through a single slit.	2. Draw the direction of the rays.
3. Write down the conditions for maxima and minima.	3.Write the law of conservation of momentum.
	4. Write the formula for the Compton wavelength.
	5. Explain why the electron's velocity decreases upon collision.

Results and Their Analysis. Demonstrating phenomena practically during physics instruction allows students to gain a deeper understanding of complex theoretical information. In this process, natural experiments, computer models, video clips, and visual physics models are used, providing students with a clear and comprehensible perception of the essence of the studied phenomena.

After the lecture content is explained, students complete pre-prepared assignments, which helps deepen theoretical knowledge, systematize it, and develop skills for its practical application. Students' cognitive activity and intellectual engagement in the classroom increase significantly.

The teacher explains the lecture by dividing it into micro-topics, ensuring step-by-step comprehension of complex concepts. Throughout the process, video materials, illustrative experiments, and group activities are widely applied. Through group work, students systematize knowledge, generalize it, and solve creative-practical tasks. For example, in statistical physics, students are assigned the task of "comparing entropy when temperature and pressure are constant," with results presented in tabular form. In optics, diffraction and interference maxima, as well as lines of equal inclination and equal thickness, are compared.

During classroom sessions, students complete creative, research-based tasks and mini-projects using lecture notes and online resources. For instance, in a "Direct Current" topic, a group is asked to solve the following problem: a radio enthusiast requires a 70 kΩ resistor, but only has 100, 50, and 25 kΩ resistors available. Can the required resistance be achieved, and if so, how? Another group works on a more complex project: identifying the main components of

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solar panels on a satellite, explaining their operating principles, and justifying the need for large surface areas.

The effectiveness of convergent lectures is enhanced through blended learning, which integrates problem-solving into lecture activities, develops practical skills, and fosters the formation of communicative models. Consequently, students participate more actively, independently, and creatively in learning activities.

Conclusion. In summary, convergent lectures not only deliver theoretical knowledge but also facilitate its deepening, analysis, and expansion. This process is supported through independent work in the information-learning environment and various forms of classroom activities. Students assimilate knowledge not only through verbal explanation but also through multiple methods, tools, and information channels. Therefore, a convergent lecture is conducted as a pre-planned communicative process. The successful outcomes achieved during sessions reinforce students' motivation to continue their activities and achieve high results. A rating system is used to assess both classroom and extracurricular activities, serving not only as an assessment tool but also as a mechanism for continuous monitoring of engagement in the educational process.

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