

**OPEN ACCESS**

SUBMITTED 10 September 2025

ACCEPTED 03 October 2025

PUBLISHED 06 November 2025

VOLUME Vol.05 Issue11 2025

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Methodology Of Using Modern Forms Of Organizing Independent Learning In Physics For Students Of The Irrigation Field

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Abstract: This article highlights effective ways of using modern pedagogical technologies and interactive methods in guiding engineering students toward independent learning in physics. The advantages of employing digital educational resources, virtual laboratories, distance learning systems, and problem-based teaching methods in organizing independent study are analyzed. In addition, methodological recommendations aimed at developing students' independent thinking, research skills, and problem-solving abilities are presented.

Keywords: Modeling, calculation, graphic tasks, tasks related to building a model of a technological process, optimization tasks.

Introduction: The main goal of higher education is to develop the necessary professional competencies of future specialists who possess the ability for self-education, self-development, and the implementation of innovative activities. This objective cannot be achieved merely by providing students with ready-made knowledge from professors or teachers. It is essential to transform the student from a passive consumer into an active creator of modern knowledge — a person capable of identifying problems, analyzing possible solutions, finding the most effective outcomes, and justifying their correctness.

METHOD

Focusing on active learning methods implies the development of students' creative abilities, the

enhancement of their professional competencies, and the transition to individualized and differentiated teaching that takes into account each learner's needs and capabilities. The main purpose here is not to simply increase the hours allocated for independent learning, but to fundamentally reconsider the principles of organizing the educational and upbringing process in technical higher education institutions.

Strengthening the role of independent student work should contribute to the development of scientific thinking, the ability to apply acquired knowledge creatively, self-development, and the continuous formation of professional competencies that enable adaptation to modern professional activities.

In the studies devoted to planning and organizing students' independent work, scholars such as M.I. Makhmutov, N.A. Polovnikova, L.G. Vyatkin, M.G. Garunov, B.P. Yesipov, V.A. Kozakov, I.Ya. Lerner, P.I. Pidkasisty, N.N. Tulkibaeva, and others have examined the organizational–activity-based, methodological, general didactic, psychological, logical, and other aspects of professional activity.

In general, independent work in physics is an activity aimed at developing the scientific and theoretical thinking of future specialists as well as their essential professional competencies. Any form of independent learning activity in physics is connected to independent work, as it creates pedagogical conditions for the emergence of independent thought and the enhancement of students' scientific cognitive activity.

Independent work refers to the student's integrated process of scientific and cognitive activity, carried out both within and beyond the classroom — in interaction with professors and teachers, or independently. It takes place directly during classroom sessions (lectures, practical lessons, and laboratory work), as well as outside the class schedule through consultations, creative discussions, and individual assignments. Students engage in independent work when solving academic and creative problems in the library, at home, in dormitories, or within the department. It should be noted that the various forms of independent work are closely interconnected and complement one another.

In the process of classroom learning, active assimilation of knowledge in physics requires, at the very least, understanding of the learning material, and ideally, its creative comprehension. In the first year of study, students primarily focus on memorizing the material and understanding physical concepts. However, in some cases, when teaching physics, an excessively formal–logical or overly mathematical approach is emphasized, while the psychological and

pedagogical aspects of perceiving complex and multifaceted physical content are overlooked (V.V. Davydov). In addition, insufficient attention is often given to interdisciplinary integration between physics and related subjects.

A system of knowledge that is not reinforced through interdisciplinary connections tends to lose its stability and systematic nature. One of the most significant motivational factors in teaching physics is emphasizing its professional orientation, which contributes to preparing students for their future professional activities.

Let us now consider the factors that promote the activation of students' independent work. Among these factors, the following can be distinguished:

- 1) Intensive pedagogical activity serves as an important motivational factor. For future engineers, it is essential to incorporate active and interactive methods into the physics learning process—primarily game-based training, which is founded on modern innovative and organizational–activity games. Such games facilitate the transition from one-sided understanding of an object to a comprehensive grasp of it, helping students identify contradictions that arise during the processes of formalization, synthesis, and modeling.
- 2) Participation in physics Olympiads, scientific research, professional or practical projects, and other creative competitions.
- 3) Awareness of the usefulness of the independent work performed. When students realize that the results of their laboratory work can be used in preparing articles for scientific-practical conferences, or that they can apply their physics knowledge in general professional, specialized, and supplementary engineering subjects, their motivation toward completing physics assignments increases, improving the quality of their work. For example, a first-year student may be given an independent task that could later serve as a component of their final qualification project—either experimental or theoretical in nature.
- 4) Participation of future engineers in creative and research activities, such as involvement in the department's scientific research, design, engineering, or methodological projects.
- 5) Use of motivational assessment tools in monitoring physics knowledge, including cumulative rating systems, tests, and both standard and non-standard examination formats. Under certain pedagogical conditions, these factors can foster a spirit of competition and intellectual challenge, which itself becomes a strong source of motivation for students.
- 6) Individualization and regular renewal of independent

learning tasks performed both in and outside the classroom.

7) The professor's personality serves as a motivational factor for students' independent work. As a professional and creative individual, the professor should serve as a role model for students. They must inspire learners to reveal their own creative and professional potential and assist them in identifying prospects for their personal and professional growth.

8) Rewarding future engineers for their achievements in scientific, creative, and professional activities is another motivating factor. This includes awarding scholarships, prizes, and incentive points, as well as implementing corrective (but not harsh) measures for underperforming students. For instance, giving higher grades for assignments completed ahead of schedule and lowering marks for late submissions encourages responsibility and motivation.

9) Individualization and constant renewal of independent learning tasks performed both during and outside of classroom activities. Such tasks should be regularly updated to maintain students' interest and engagement.

10) The professor's personality remains a crucial motivational factor for independent learning. As a professional and creative figure, the professor must serve as a role model for students, inspiring them to reveal their creative and professional potential. The instructor should also guide students in identifying prospects for internal professional growth and self-development.

11) The motivation for independent learning in physics can be enhanced by employing a cyclical learning model. The immersion method helps intensify the study of course material, as varying the time intervals between physics classes keeps students' attention consistently focused on the subject and reduces the rate of forgetting. Independent learning sessions within this framework may cover several topics from the physics course, allowing students to establish stronger conceptual connections and retain knowledge more effectively.

In technical higher education institutions, the main strategic approach to organizing students' independent work is not to optimize individual forms of such activity, but rather to create pedagogical conditions that ensure students' activeness, independence, and responsibility in all types of learning—both in and outside the classroom. Reducing the number of classroom sessions in favor of independent work cannot, by itself, improve or even maintain the quality of education. This is because lectures, practical, and laboratory classes play an

essential role and cannot be simply replaced by additional hours of independent work, as such an approach might lead to passive learning instead of active engagement.

According to the state educational standards (particularly under the credit-module system), more than half of a student's total study time is allocated to independent learning outside the classroom. This time can be used entirely for independent work. Moreover, the hours designated for independent study constitute a substantial portion of the total course load assigned for classroom activities. Therefore, in teaching physics, the real issue is not the number of hours available for independent work, but rather how effectively those hours are utilized.

The process of organizing independent learning in physics for future engineers can be implemented in two main directions:

1. Enhancing the role of independent work during classroom sessions.

This approach requires the development of methods and forms of instruction that allow professors to maintain a sufficient degree of student autonomy, ensuring the effectiveness of their independent scientific, cognitive, and professional preparation activities during lectures, laboratory, and practical classes.

2. Increasing student activity during out-of-class independent work.

This involves creating favorable pedagogical and motivational conditions that encourage students to actively engage in independent tasks, apply their physics knowledge creatively, and connect it with real-world engineering applications.

The main task of organizing students' independent work in physics is to create psychological, pedagogical, and didactic conditions for the development of intellectual initiative, essential professional competencies, and theoretical physical thinking during any form of academic activity — lectures, practical lessons, laboratory sessions, or study groups.

The organization of independent work in physics should aim to develop students' ability to understand physical theories independently, enhance their scientific inquiry skills, and strengthen competencies related to solving conceptual and problem-based physics tasks.

The primary goal of organizing independent student work is to teach learners to consciously and independently study educational materials, scientific and methodological literature, form professional competencies, improve their readiness for scientific research activities, develop self-organization skills in

scientific cognition, and foster a continuous desire for self-education and professional growth.

The leading role in organizing students' independent work belongs to the professor or instructor, who should not work with a generalized group of students, but rather with each individual—considering their strengths, weaknesses, and personal abilities. The instructor's task is to identify and develop the student's best qualities as a future engineer.

Thus, independent student work in physics is carried out through three interrelated forms:

Out-of-class independent work under the supervision of a professor;

In-class independent work guided by the instructor;

Independent participation in scientific research activities.

In physics, in-class independent work is conducted during lectures, practical exercises, and laboratory sessions. During practical and laboratory classes, various types of independent activities make the learning process more engaging and increase the overall activeness and participation of students within the group.

Students are recommended to prepare their independent work using the following forms, taking into account certain specific characteristics:

Study module topics based on the use of regulatory documents, educational, and scientific literature;

Master the lecture sections using distributed (handout) materials;

Work on specific sections or topics of the module using specialized literature;

Study in depth the sections and topics related to the student's professional activity.

The use of interactive teaching methods in organizing independent learning plays a significant role. These methods allow students to conduct exploratory learning according to the topic, text, or section. They help develop systematic thinking, the ability to structure and analyze information, and encourage active participation.

At the initial stage, students become familiar with the requirements and rules of the method, and then they prepare method tables in small groups

"Each One Teach One" technique is a teaching method that enables learners to become instructors themselves — after mastering certain knowledge, they share it with their peers. The goal of this method is to provide students with the maximum amount of necessary information during the learning process,

while simultaneously stimulating their interest in both acquiring and sharing knowledge. After receiving information, the learner tries to deliver it to as many peers as possible within a given period.

Application:

Used to stimulate students' interest in obtaining and sharing information, to encourage careful listening and retention of the topic.

Advantages:

Develops the ability to express one's thoughts concisely;

Enhances listening and memory retention;

Increases interest in the subject or topic.

RESULTS AND DISCUSSIONS

To motivate students' independent learning, professors develop and conduct club sessions (study circles) dedicated to specific topics in physics. As a rule, the topics of these sessions must meet two key criteria:

firstly, they should be professionally oriented, and secondly, they should address problem-based issues that are either briefly covered or not included at all in the lecture course.

Preparation for such a session encompasses the entire cycle of educational and scientific cognitive activity, including:

compiling summaries based on relevant literature;

memorizing and understanding the content;

generalizing the acquired knowledge;

systematizing and applying it effectively.

CONCLUSIONS

In lectures, practical lessons, laboratory work, independent studies, and club sessions in physics, constructing a conceptual methodological system helps organize teaching aimed at guiding future engineers toward professional activity. Through this approach, a methodology is developed and implemented in teaching physics that promotes the formation of essential professional competencies such as designing, constructing, and research skills.

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