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## **THE PROJECT METHOD AS A TECHNOLOGY OF TEACHING PHYSICS TO STUDENTS OF TECHNICAL UNIVERSITIES**

***Abstract:** this article defines the concepts of «project method», «independent work of students». The role of the teacher in the project method is defined, the main requirements for the use of the project method and its advantages are presented. The basic principles of teaching and a number of factors controlled by the teacher in the learning process and influencing the successful construction of knowledge and the effective work of the student on the project are presented. The application of the project method allows taking into account the individual characteristics of students and provides them with additional opportunities for personal and professional development.*

***Keywords:** design method, physics, engineering education, professionally oriented tasks.*

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## **ПРОЕКТНЫЙ МЕТОД КАК ТЕХНОЛОГИЯ ПРЕПОДАВАНИЯ ФИЗИКИ СТУДЕНТАМ ТЕХНИЧЕСКИХ ВУЗОВ**

***Аннотация:** в статье даны определения понятиям «проектный метод», «самостоятельная работа студентов». Определена роль преподавателя в проектном методе, представлены основные требования к использованию проектного метода и его преимущества. Представлены основные принципы преподавания и ряд факторов, контролируемых преподавателем в процессе обучения и*

влияющих на успешное формирование знаний и эффективную работу студента над проектом. Применение проектного метода позволяет учитывать индивидуальные особенности студентов и предоставляет им дополнительные возможности для личностного и профессионального развития.

**Ключевые слова:** метод проектирования, физика, инженерное образование, профессионально ориентированные задачи.

### *Introduction*

At the present stage of the socio-economic development of the state, it is of great importance to increase the educational level of highly qualified specialists, enrich their intellectual and scientific potential in the professional field. The changes taking place in the education system orient the student towards competitiveness and the development of creative initiative and independence [1].

What is «independence»? Independent work of a student is his educational activity, planned under the methodical guidance and supervision of a teacher, but without his direct participation. One of the effective methods of organizing students' independent activities is the project method [2].

The project method is a teaching method in which students develop a project with the help of collective or individual activities for the selection, distribution and systematization of material on a specific topic, followed by its protection [3].

The role of the teacher in the project method is special, since he acts as a coordinator and therefore must develop a consistent concept; at the same time, he must be well-versed in information material, have a high professional level. When applying the project method, especially for undergraduates, there is also a need to integrate various subjects. Interdisciplinary connections solve the existing contradiction between the disparate assimilation of knowledge and the need for their synthesis, integrated implementation in practice, and professional activity. From the standpoint of modern requirements for the content of education, a specialist must have the skills and professional mobility to respond promptly to constant changes in practice [4].

The results of completed projects should be, as they say, «tangible», that is, if this is a theoretical problem, then its specific solution, if practical – a specific result ready for use (at a seminar, in independent work, etc.). If we talk about the project method as a pedagogical technology, then this technology assumes a set of research, problem-based methods, creative in their very essence.

Basic requirements for using the project method:

1. Definition of the purpose, problems and objectives of the study (using the method of brainstorming, round table, etc. in the course of joint research).
2. Hypotheses for their solution.
3. Discussion of research methods (statistical methods, experimental methods, etc.).
4. Collection, systematization and analysis of the data obtained.
5. Discussion of ways to design the final results (presentations, protection, creative reports, views).
6. Summing up, design of the results, their presentation.
7. Conclusions, presentation of new research problems [5].

It should be remembered that the work on the implementation of projects allows you to significantly intensify the work on self-education. It is known that self-education is the most important means of forming human qualities. Self-education is characterized by the presence of active cognitive needs and interests, the motivation of a person to satisfy them, and the manifestation of a high degree of consciousness and organization. Project execution is a creative process, self-education brings students much closer to creativity, i.e. project activity stimulates the process of self-education, and self-education stimulates creativity [6].

The role of creative projects for mental education is due to the fact that in the process of creative activity, future engineers expand the range of perception and ideas, develop and improve cognitive abilities, form the main processes of mental activity, develop the ability to independently acquire knowledge and apply it in practice.

The effectiveness of the application of the project method depends on the level of training of the subject of training. He must have such skills as: intellectual (work

with information, analyze, systematize, generalize, establish associations with previously studied, draw conclusions); creative (put forward ideas, find solutions, anticipate possible consequences of decisions); communicative (defend his own point of view, find a compromise, predict his result); social (be responsible for the results of their work, understand and respect the point of view of others) [7].

Advantages of the project method:

1. Students gain new knowledge and skills in the process of independent preparation of an information retrieval project.
2. Students are fully immersed in the learning process in accordance with their needs, interests and capabilities and improve their skills by solving theoretical and practical problems.
3. Students learn to solve unique, non-standard tasks.
4. Students acquire the ability to decide independently and make decisions independently.
5. Students have the opportunity to share their own experiences with other students.
6. Even during the training of students, this method develops professional experience, which consists in professional initiative, independence, and communication skills.
7. The method develops the social qualities of students, fosters responsibility [8].

Studying the special course, students go through all stages of design, which ultimately gives them an idea of the sequence of project creation and the rules for their implementation. When receiving a task to complete a project (mini-project), students have the opportunity to independently choose the topic of the project according to their interests, based on their own ideas about the need to solve a particular problem. They learn to identify problems, identify goals and tasks that may face them in the course of their professional activities. Moreover, they learn to find ways to solve these problems. It will be interesting and useful for students to use the knowledge gained in classes in other subjects in the course being studied. The use of project

methodology in this course allows students to develop useful skills: search, selection, systematization and analysis of information, work with primary sources, design and public presentation of projects. Having come to work at industrial enterprises, a young specialist will be able to fully use the skills that he has acquired by carrying out various projects.

The choice of the project form of conducting final classes is explained by the fact that this form of training organization, chosen as a priority for teaching, can significantly increase the effectiveness of training. Therefore, the basic principles of training will be:

1. Activation of the activities of each student of the group. This means that every student should be involved in an active educational and cognitive process at all levels of mastering new material, mastering various types of activities.

2. Learning is based on the assimilation of the theory and methodology of the project method, the result of which is a creative project.

3. Reliance on conscious assimilation of the material.

4. Cooperation and mutual assistance in the teacher-student mode at all levels of mastering the material and its application.

Knowledge design implies creative cooperation between the teacher and the student, intellectual partnership, and active activity on the part of the student. However, it should be noted a number of factors controlled by the teacher in the learning process and influencing the successful construction of knowledge and the effective work of the student on the project:

1. Formation of a knowledge base that forms the basis for starting independent work on a project.

2. Focus on new knowledge gained in the process of research.

3. Control over the correct interpretation of knowledge.

4. Developing the ability to construct knowledge.

Practical classes should be devoted to discussing the problems that arose when doing independent work and developing projects. In the process of solving problems, different points of view are expressed, discussions are held, students agree and argue,

prove their position, and at the same time learn the subject under discussion more deeply. It is projects with their problems that make it possible to realize the whole range of learning goals, including economic issues.

The project method used in teaching physics assumes that students independently or in groups develop or choose a project topic, and then carry out all stages of its implementation – from setting a task to presenting the results. This approach allows students to learn more deeply the basic concepts and laws of physics, as well as learn how to apply them in practice. This method is based on the principles of active and independent work of students. Future engineers themselves determine the goals, research methods, as well as ways to present the results [9]. Such participation of students in the learning process allows them to develop self-education and self-development skills, as well as a fundamental understanding of the principles and laws of physics.

The project method in teaching physics also contributes to the integration of knowledge. Students can use knowledge and skills acquired in other disciplines to solve problems within the framework of the project. For example, to create a prototype device or conduct an experiment, you may need programming, electronics, or design skills. This method allows students to see in physics not only abstract laws and formulas, but also their applicability in real life. When solving problems and problems related to real objects and phenomena, students take into account not only theoretical aspects, but also practical possibilities of implementing their project. In this way, students can better understand how to apply physical laws to solve real-world problems in their future professional activities. The design method in teaching physics to students of technical universities helps to prepare engineers who are able to effectively apply physical knowledge and skills to develop and implement new technologies, as well as solve complex engineering problems.

Engineering activity in the conditions of modern technological structure takes place in multidisciplinary information environments. The established trend towards digitalization of professional activity and daily life of a person forms new demands for the system of training engineering specialists. An up-to-date analysis of the con-

tent of professional training of a specialist in higher education is associated with the prospects for the formation of hybrid interactive environments based on smart systems and convergent technologies.

The intensive development of the technological environment of professional activity requires the integration of knowledge in engineering practice. This circumstance, in turn, poses new challenges to the system of training specialists who have the skills to navigate in complex, intellectually loaded information environments. In this regard, it is extremely important to expand rational methods of training an engineer, whose qualifications should allow him to navigate the interdisciplinary field of professional interactions, take an active part in all stages of creating breakthrough technologies – from conception to practical implementation and operation of projected facilities. The introduction of the design method into the engineering education system is based on the synthesis of knowledge from various professional fields, requires rethinking the place and role of specialists in a world determined by digital technologies.

In the current situation, the development of interdisciplinary practices in the learning process is determined by the orientation of universities to the organization of project activities, which allows combining various competencies in the educational trajectory of a future specialist.

Thus, the application of the project method allows taking into account the individual characteristics of students and, therefore, provides them with additional opportunities for personal and professional development, helps to achieve higher learning outcomes and teach them to carry out interdisciplinary and intrasubject communication in the educational and research process, as well as contributes to students' awareness of the importance of studying subjects and the role of scientific knowledge in professional and personal development.

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