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# Using the project method to motivate students studying physics

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**Abstract.** Modern graduates of physical specialties are required not only to possess a certain amount of knowledge, but also to be able to apply this knowledge to solve practical problems, as well as independently acquire the knowledge required for their professional activities. During the implementation of projects, students have the opportunity to solve practical professional problems. The use of the project method in teaching students of physical specialties, in our opinion, allows to increase the degree of interest of students in acquiring new knowledge. In the process of implementing projects, students gain skills of teamwork on the project, they develop systematic and analytical thinking. In addition, the implementation of the project allows students to acquire the skills to independently formulate a project implementation plan and search for information necessary to solve the problem.

## 1. Introduction

The methods used in active learning contain problems that require the learner to independently learn new skills and knowledge, as well as acquire new competencies. This, in our opinion, allows you to prepare a specialist capable of solving complex and non-trivial professional tasks, able to work in a team. Knowledge means the ability to use knowledge to solve specific problems. According to [1] in the learning process, students can additionally develop creative thinking skills, encouraging them to pose and solve problems, formulate hypotheses, and independently search for the best option for solving problems.

According to [2-4] the learner learns better not ready-made information, but their answers to questions that arise when they need to solve practical problems.



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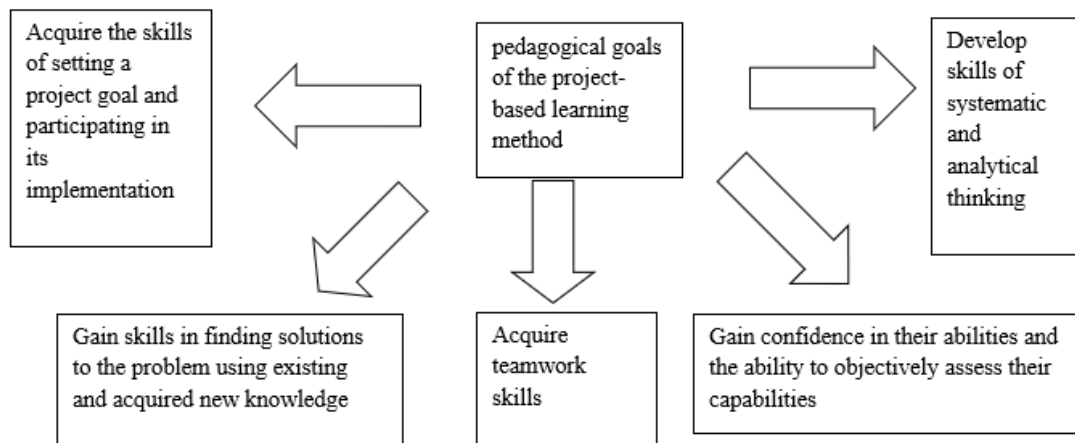
According to [5] the most optimal way to learn new knowledge is to create cognitive action in a specific problem situation.

In our opinion, to achieve this goal, it is necessary to modify not only the content of the learning process itself, but also to change the methodology of organizing the educational and educational process, focusing on motivating independent cognitive activity of students. This, in turn, will require the use of modern educational technologies that are focused on the personality of the student.

One of the most common personal educational technologies is the project method. According to [6] the project method is a learning system in which trainees have the opportunity to acquire new skills and knowledge when planning and implementing practical tasks in the form of projects.

According to [7-8] the project method is a pedagogical technology that is based not on passive acquisition of knowledge, but on the acquisition of new knowledge through participation in practical activities.

According to [9] the main idea of using the project method is to combine classroom and extracurricular work of students to implement the project. This contributes to the formation of creative thinking and positive motivation for learning among students.



**Figure 1.** Pedagogical goals of the project-based learning method.

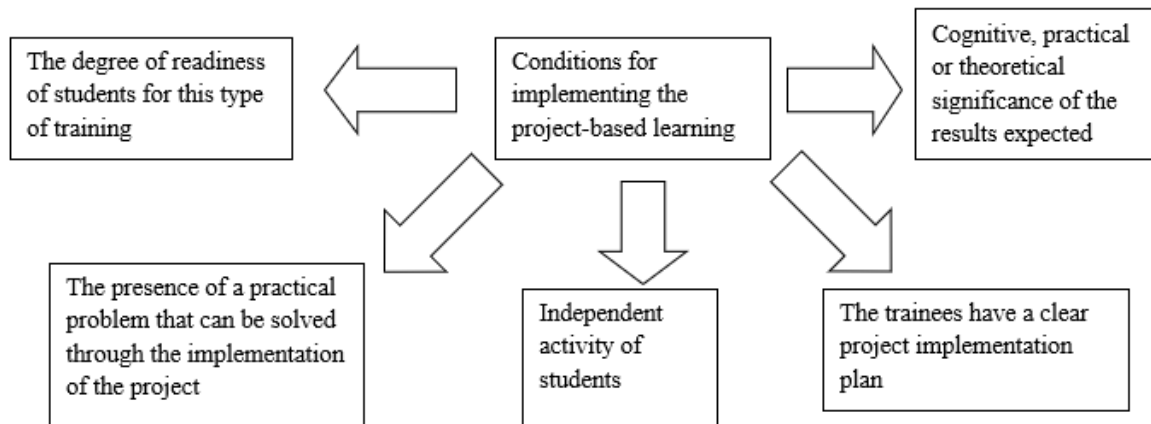
According to [10] taking part in the implementation of the project, the student has the opportunity to realize their abilities, and also at the same time acquires the skills of acquiring new knowledge and skills.

According to [11-12] project-based learning technology has tools that intensify and activate students' thinking and creative activities. It always provides for the solution of some problem, through the application of various methods and means of training and the integrated use of skills and knowledge from various branches of technology, science and technology, while mobilizing the creative abilities of students.

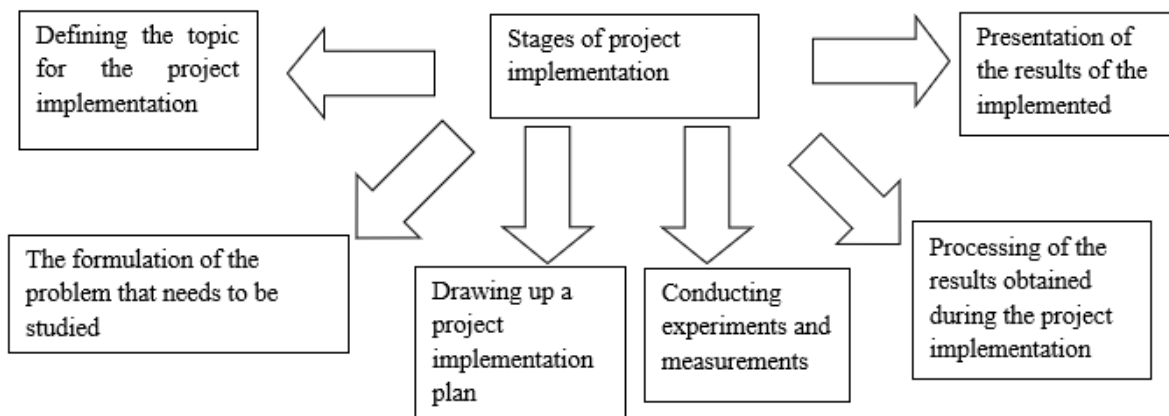
According to [13] the results of implemented projects should represent a concrete solution of practical significance.

According to [14] the main pedagogical goal of the project-based learning method is to create the necessary conditions under which students (figure 1.)

According to [4, 15] basic conditions needed to implement the design method of training are Figure 2.



**Figure 2.** Conditions for implementing the project-based learning method.



**Figure 3.** Stages of project implementation.

According to [16], [17] the use of project-based teaching methods allows to avoid the authoritarian nature of the educational process, to achieve increased motivation and personal initiative of students. The implementation of the project provides students with the opportunity to realize their creative and professional potential.

In our opinion, the implementation of projects related to the study of physical problems should have a clear structure, clearly defined goals and objectives of the study, designated methods of data collection and processing.

The authors [18] distinguish projects with open coordination (when the teacher takes a dominant role during the implementation of the project coordinating and organizing the activities of other project participants), as well as projects with hidden coordination (when the teacher allows students to independently organize their work and implement the project, intervening only if students have difficulties with the implementation of the project).

In our opinion the implementation of the project related to the study of a physical problem can be divided into the following stages (figure 3).

## 2. Methods

When performing this study, we used an analytical method. This made it possible to consider the problems studied in the article in their development, unity and interrelation.

Taking into account the goals and objectives of this work, systematic and structural-functional research methods were applied.

All this made it possible to study a number of issues related to the use of the project method in the training of specialists in physical specialties.

### 3. Results

In our opinion, the use of the project methodology in teaching physics allows:

- Develop students' skills of active creative and practical activity,
- Distribute responsibilities among project participants, taking into account the interests and abilities of individual students.
- Create an atmosphere of joint creativity in the classroom.
- Increase the motivation of students to independently acquire new knowledge and skills.

In our opinion, in laboratory classes in physics as projects, in our opinion, you can use:

- Computer experiments. They allow you to avoid the use of expensive equipment and materials and at the same time allow you to better understand the meaning of physical phenomena.
- Calculation problems with the use of computer verification. To begin with, students are asked to solve the problem without using a computer. Then a computer experiment is performed and the data obtained as a result of the computer experiment is analyzed. You can also ask students to work out the study material independently as a homework assignment, then discuss it in the classroom, and then conduct a computer experiment.
- Ambiguous problems. In this case, the student is asked to solve a problem in which it is necessary to determine the values of several parameters. To solve such problems, the teacher chooses the value of some parameters and students must first theoretically calculate the missing parameters, and then conduct a computer experiment and analyze the results.
- Problems with missing data. Before conducting a laboratory practical lesson, the teacher does not tell students all the data. During the implementation of the project, students should independently find out what data is missing and find it themselves in various sources of information.
- Experimental tasks. In this case, experiments are carried out without the use of computer simulations by using real instruments and materials. Then the results of the experiments are processed, analyzed and compared with the prediction of the theory.

The use of computer experiments in laboratory physics classes improves students' motivation to improve their knowledge

### 4. Discussion

The use of the project-based learning method during laboratory practical classes in physics, in our opinion, allows you to organize a team work of students, in which each of them is assigned a certain role. Of the plurality of tasks faced by all participants in the project is composed of a single research training project. In the process of implementing the project, each of the project participants creates a database of final results. The results of their work are summarized by each participant in the form of a report, which is provided in analytical and graphical form. Following the results of the project implementation, students together with the teacher discuss the results obtained and summarize the results of the work carried out.

### 5. Conclusions

In our opinion, the design method can play a role in the study of physics. Since the implementation of the project on the one hand increases the efficiency of acquiring new knowledge, and on the other hand contributes to the growth of motivation to study physics.

While working on the project, students of future specialists in the field of physics develop the following skills and abilities:

- Planning upcoming activities and forecasting their results.
- Study of cause-and-effect relationships, development of project implementation options.
- Independent search for information necessary for the implementation of the project.
- Teamwork, mutual assistance and search for compromise solutions
- Ensuring the organization of the workplace for conducting experimental research (selection of equipment, materials).
- Understanding the results of experimental research.
- Building a presentation about the work performed and its public protection.

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