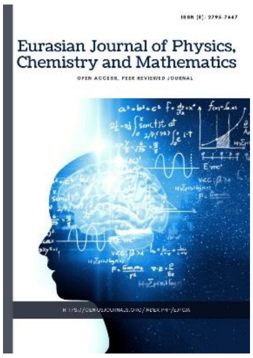


# The Formation Of Interest In Physics In Schoolchildren Based On Didactic Approaches

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**ABSTRACT**
This article explores modern didactic approaches that effectively engage pupils in the physics learning process. It discusses problem-based learning, interactive methods, project-based instruction, and the integration of digital technologies. Practical examples are used to demonstrate how these strategies enhance pupils' critical thinking, inquiry skills, and interest in physics education.

**Keywords:** Didactic approach, problem-based learning, interactive methods, project-based learning, digital technologies, physics education, pupil engagement.

## Introduction

In modern pedagogy, one of the pressing issues is enhancing the effectiveness of education, deeply engaging pupils in science, and encouraging independent thinking. Particularly in teaching physics, which belongs to the category of exact sciences, awakening pupils' need for knowledge, understanding the essence of the subject, and explaining it in relation to real-life situations requires a special methodological approach [1-3]. This is because physics is rich in abstract concepts, complex theories, and mathematical expressions. Forming these concepts in pupils' minds and conveying them in an understandable and memorable manner is closely linked to the correct selection of didactic tools and their effective application.

Fundamental changes in the education system, rapid development of information and communication technologies, interdisciplinary integration, creative approaches, and active implementation of innovative methods by teachers are resulting in a new look for the process of teaching physics. In this context, didactic approaches, namely methods that stimulate pupil activity and directly involve them in the lesson process, play a particularly important role [4, 5]. The content and format of lessons, organized with consideration of pupils' individual characteristics, interactivity, use of visual aids, and teaching approaches based on problem analysis serve as crucial factors in developing pupils' scientific thinking.

This article analyzes the theoretical foundations of modern didactic approaches, their methodological significance in teaching physics, and their role in engaging pupils in science. Also, the experience of teaching physics through advanced teaching methods, their pedagogical effectiveness and influence on educational results are substantiated.

## Main part

The effectiveness of modern physics education largely depends on the didactic approaches employed by the teacher. Pupils' interest in physics, their deep assimilation of knowledge, independent thinking, and ability to apply it in practice are directly influenced by the correct selection and application of teaching methods. Engaging pupils in active participation during lessons, encouraging them to ask questions, express opinions, and conduct experiments should become the focal point of educational activities. Below, we will discuss in detail the main types of such didactic approaches and their practical implementation in the lesson process.

*1. Problem-based learning.* Problem-based learning is one of the educational methods aimed at developing pupils' independent thinking, research activity, and skills in analyzing problems based on a scientific approach. This form of teaching requires the teacher to have a deep knowledge of their subject, and demands that pupils engage in reasoning, posing questions, formulating hypotheses, and drawing conclusions based on experience. This approach is particularly important in physics for shaping scientific views, understanding cause-and-effect relationships, and connecting theoretical knowledge with practical applications [6].

In problem-based learning, knowledge is not viewed as ready-made information provided by the teacher, but as a process created by the pupil through active cognitive engagement. In this context, the teacher does not act as a source of knowledge, but rather as a facilitator who manages, guides, and organizes the learning process.

The problem itself is an ambiguous situation for the pupil, which they cannot resolve within the scope of their existing knowledge, but which encourages investigation. This situation prompts the pupil towards intellectual activity, motivating them to independently seek out knowledge and assimilate it.

In problem-based learning, the pupil:

- becomes active in acquiring knowledge;
- poses questions and attempts to find answers to them;
- tests their hypotheses through practical experiments and observations;
- draws conclusions based on critical thinking;
- substantiates their personal position.

The methodological foundation of problem-based learning lies in the "zone of proximal development" (ZPD) theory by the renowned Russian psychologist Lev Vygotsky [7]. According to this theory, each pupil possesses a range of knowledge they can independently apply, which can be further expanded through problem situations appropriately designed by the teacher. pupils acquire new knowledge through the process of independent thinking and problem-solving. This is not mere memorization, but knowledge gained through cognitive development.

Additionally, the ideas of J. Piaget and J. Bruner on cognitive development are considered one of the primary methodological pillars of problem-based learning [8].

Stages of problem-based learning

A lesson organized using a problem-based approach includes the following stages:

1. Creating a problem situation - a question or situation is presented that the pupil cannot solve with their existing knowledge, but which encourages them to investigate.
2. Recognizing the problem - the pupil realizes that there is a problem in the situation and understands the need to solve it.
3. Formulating assumptions and hypotheses - the pupil suggests a way to solve the problem based on their existing knowledge.
4. Conducting an experiment or observation - a practical action is performed to test the proposed hypothesis.
5. Analyzing the results and drawing conclusions - based on the experimental results, the solution to the problem is identified and generalized.

Examples for practice

Here are some examples of applying the problem-based approach to physics:

Example 1: In the Mechanics section.

Problematic question: "Why does a person move forward when a car brakes?"

This question requires pupils to understand a phenomenon familiar from everyday life, but

physically in need of explanation. The teacher asks this question and opens the discussion. pupils propose hypotheses, such as:
"Due to inertia."
"The body tries to continue moving."
Then the teacher conducts a simple experiment: how does a ball, placed on a cart, move when it is braking? As a result, the law of inertia is proven in practice.
Example 2: In optics section.
Problematic situation: "If we look at a pencil submerged underwater, why does it look curved?"
This question is also based on everyday experience. pupils make the following hypotheses:
"The eyes are being deceived."
"Light moves in water at different speeds."
Then the teacher explains the law of refraction, shows an experiment with the angle of refraction and the speed of light. Through practical observation, pupils come to the conclusion that light appears curved due to the phenomenon of refraction between media.

Advantages of problem-based learning

- Pupils learn to think, develop their knowledge independently, and not ready-made information;
- Skills of independent work and scientific research are formed;
- Theoretical knowledge is inextricably linked with practical activity;
- A culture of communication and discussion develops among pupils;
- The role of the teacher changes - as an assistant and guide.

*2. Interactive teaching methods.* Interactive teaching methods are considered one of the most effective approaches in modern pedagogy. These methods are based on the principle that places the pupil's personality at the center, seeing him as an active participant in the process of acquiring knowledge. In interactive learning, the teacher is not only the giver of knowledge, but also the guide, the initiator of discussion, and the organizer. pupils participate in the lesson not only as listeners but also as individuals who express their thoughts, analyze, and draw conclusions [9, 10].
Interactive learning is based on the principles of constructivist pedagogy. This approach is considered one of the important turning points in pedagogical thinking of the 20th century. Its founders are such famous educators and psychologists as John Dewey, Lev Vygotsky, Jerome Bruner, Jean Piaget. In particular, Dewey placed activity at the center of the learning process as a proponent of "learning through experience." Vygotsky emphasized the social nature of acquiring knowledge in education through social communication and the concept of the "zone of proximal development." According to these theoretical views, knowledge should not be given to the pupil in a ready-made form, but should be formed by the pupil himself in the process of activity, communication, and discussion.

Advantages of interactive methods:

- Develops thinking - pupils think independently, provide evidence, and engage in discussions.
- Encourages a creative approach - each pupil offers a unique approach.
- Increases social activity - pupils develop the ability to work in a group, exchange ideas, and compromise.
- Serves for solid assimilation of concepts - the studied topic is covered from different points of view.
- It reveals the connection of science with real life - through examples and situations, topics are mastered in a life context.

Examples for practice
1. Brainstorming. In this method, the teacher poses a question or a problematic situation, and all pupils freely express their opinions. For example, the question "Why does a metal object feel colder when touched?" discusses the essence of thermal conductivity. Pupils make their assumptions, after which the teacher gives the correct explanation through the experiment.
2. Round Table. Pupils are divided into small groups, and each group expresses their opinion in a circular order. With the help of this method, all pupils participate in the discussion. For example, in the topic "Types of energy and their mutual conversion," pupils discuss various situations.

3. Role Play (Role Play). Through this method, pupils take the place of a physical phenomenon or a scientist-discoverer and speak on their behalf. For example, one group brought Galileo Galilei to life, another Isaac Newton, and a scientific debate was organized between them. This method reinforces physical knowledge in a historical context.
4. Debates. In debates, pupils defend opposing views. For example, on the topic "Is Nuclear Energy Hazardous or Useful?," pupils express their opinions based on scientific evidence. This process develops in them the skill of scientifically based thinking.
5. "Single Point" Method. In this method, each group presents a single opinion agreed upon during the discussion. For example, the question "Why are materials with high thermal conductivity not used in thermal insulation?" is asked, and each group presents one justified answer based on discussion.

Interactive methods stimulate the learning process, increase pupils' attention, and encourage independent thinking. These approaches are especially relevant for such a complex and multifaceted subject as physics, attracting pupils not only to theoretical knowledge but also to practical experience, analysis, and communication. Through this, physics becomes closer to life, pupils' interest in it increases, and deep understanding emerges.

*3. Project-Based Learning (Project-Based Learning).* In the modern educational process, one of the important tasks is the formation of pupils' independent thinking, analytical approach, and problem-solving skills. The role of project-based teaching methodology in the development of such skills is invaluable. This approach serves the formation of pupils' skills in independently solving real-life problems based on scientific methods, analyzing and presenting the results. Since the subject of physics, by its very nature, is aimed at studying natural phenomena and applying them in life, the effectiveness of the project approach is even more clearly manifested in the educational process in this subject.

The theoretical foundation of project-based learning is connected with the ideas of constructivist pedagogy, developed at the beginning of the 20th century by the American pedagogue-philosopher John Dewey and his pupil William Kilpatrick. Dewey emphasized the necessity of conducting education based on life experience. Kilpatrick further developed this idea, promoting project activities as the main form of education. According to their theory, pupils should acquire knowledge not in a ready-made form, but through research, observation, and problem-solving activities. Such an approach increases the pupil's activity, develops independent thinking and the ability to take responsibility [11].

When applying the project-based teaching method to physics lessons, topics related to energy, heat, electricity, and ecology create a very convenient platform. As an example, in the 8th grade physics lesson, one can organize project activities called "Project for Reducing the Use of Electricity in My Home."

Project stages are implemented as follows:

1. Identifying the problem: pupils are asked questions such as "How much electricity does your family consume in a month?" and "How can this consumption be reduced?" pupils understand the problem and develop an interest in solving it.
2. Conducting research: pupils observe the daily, weekly, and monthly consumption of electricity in their home. They collect data on the energy consumption of various devices, draw graphs and diagrams.
3. Developing hypothetical solutions: pupils develop recommendations such as proper use of devices, use of energy-saving equipment, and avoiding excessive lighting and heating.
4. Formalization of the results: Groups prepare a presentation on their project. In this presentation, they substantiate their conclusions through observations, statistical analyses, graphs, and diagrams.
5. Presentation and Assessment: Each group presents their project in front of the class. The teacher evaluates based

on criteria: content accuracy, scientific approach, presentation style, creativity, and teamwork skills.

Results

Such an approach not only increases the level of pupils' knowledge, but also develops their research skills, the ability to search for information, analyze it, and apply it to practical problems. They learn to justify their opinions with evidence, work in a group, and visually represent the results. Most importantly, the pupil deeply understands the energy problems occurring in their home, family, and society, and develops a sense of indifference to them.

*4. Teaching based on digital technologies.* The rapid development of information and communication technologies (ICT) is causing fundamental changes in the modern education system. In particular, since the uniqueness of physics consists of a combination of complex theoretical concepts, mathematical models, and real experiments, digital technologies create a great opportunity to facilitate the study of this subject, revitalize it, and actively engage the pupil. Digital teaching methods include multimedia presentations, interactive lessons, simulations, virtual laboratories, online tests and tests, electronic textbooks, and digital projects.

Teaching based on digital technologies is based on the theory of media pedagogy and the concept of multimodal learning. Media pedagogy envisions increasing the effectiveness of education based on the provision of knowledge, communication, and interactivity through the media. The multimodal approach ensures the solid assimilation of knowledge when it is transmitted through several channels (text, audio, video, graphics, interactive models). At the same time, according to the constructivist approach, pupils actively shape their knowledge based on their own experience, and digital technologies expand these possibilities [12, 13].

Examples for practice:

1. Virtual experiments: In physics lessons, through the "PhET Interactive Simulations" platform, it is possible to simulate such complex phenomena as electric current, electromagnetic induction, Newton's laws, types of motion in a virtual environment. For example, 9th-grade pupils conduct a virtual experiment with elements of an electrical circuit (resistor, capacitor, ammeter, voltmeter) and see the confirmation of Ohm's law. This experiment is safe and can be repeatedly tested in a real laboratory.

2. Simulations and animations: Visual representation of concepts such as gravity, refraction of light, propagation of electromagnetic waves through 3D animation increases the pupil's interest and expands their imagination. For example, as a result of animated representation of the dispersion of light through a prism, the pupil deeply understands the color spectrum.

Didactic advantages:

- The ability to explain complex concepts in a visual and interactive way;
- A favorable environment for independent learning and self-assessment;
- Formation of digital literacy and skills in using modern technologies in pupils;
- Providing safe, inexpensive, and reusable tools for conducting experiments.

In conclusion, teaching based on digital technologies not only actively involves the pupil in scientific processes in physics, but also enriches them with skills at the level of the requirements of the 21st century. Therefore, these technological approaches in physics lessons are considered extremely effective and promising from a didactic point of view.

**Conclusion**

In modern education, the importance of didactic approaches that encourage pupil activity, encourage them to scientific research, critical and creative thinking, is incomparable. Unlike the traditional model of knowledge transfer, the pupil's participation as an active subject in the learning process is a priority task of today's education. Physics, with its theoretical foundations, practical aspects, and experimental nature, creates ample opportunities for applying these approaches.

Modern methods, such as project-based learning, interactive methods, the use of digital technologies, reflection, and self-assessment, not only increase pupils' interest in the subject, but also form their life skills, such as independent thinking, teamwork, problem analysis, and finding solutions. Through such approaches, physics lessons become not only a source of knowledge, but also a field of discoveries for pupils.

Thus, didactic approaches that involve the pupil in physics lessons should become an integral part of the methodological resource of the modern teacher. This serves not only to increase the effectiveness of pupils, but also to improve the overall quality indicators of the education system.

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