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ELEMENTARY CONCEPTS OF SOLAR PHOTOVOLTAICS IN PHYSICS EDUCATION AND METHODS OF TEACHING THEM

Abstract: *This article is devoted to the possibilities of forming fundamental concepts about non-conventional energy sources in the teaching of physics in secondary schools.*

Key words: *Solar photovoltaics, geothermal energy, bioenergy, potential barrier, physical and technological bases.*

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Introduction

The rapid development of new information in the continuous development of various fields of science has posed great challenges and challenges to modern methodology. What needs to be done to acquaint students with modern knowledge and master the science is becoming a pressing issue. Educators from all over the world are puzzled by this problem.

The use of new pedagogical technologies in the teaching of physics, the use of interactive methods in the teaching process and the introduction of new interactive methods in the education system. To achieve these goals, the following tasks were set: [1]

1. Identify pedagogical technologies that are effective in the teaching of physics.

2. Development of technology for the application of selected interactive methods on relevant topics.

3. Test, analyze and select the most effective methods of using these interactive methods in the teaching process.

One of the most pressing issues facing a physics teacher today is the design of modern teaching technologies and their application in teaching practice. A physics teacher should not only provide students with the necessary knowledge of physics, but also be able to arouse their interest in science, so that they can develop a good specialist in this field.[2]

Every lesson the teacher takes should be different from the other, perfect for today's lesson.

New pedagogical technologies:

─ Using the media;

─ with the help of visual aids;

─ using interactive methods; etc., this lesson will reach the student's mind and take place in his memory. The student's scientific outlook expands and the level of knowledge increases.

The goal of modern education, unlike traditional education, is to achieve high results in a short period of time without spending too much mental and physical effort. Delivering certain theoretical knowledge to students in a short period of time, developing in them the skills and competencies for a particular activity, as well as monitoring the activities of students, knowledge, assessment of their knowledge, skills and abilities from a physics teacher requires great pedagogical skills and a new approach to the educational process.[3]

Today, in many developed countries of the world, there is a great deal of experience in the use of new pedagogical technologies that increase the scientific activity and creativity of students, as well as ensure the effectiveness of the educational process. The methods that form the basis of this experiment are called interactive methods, and the ability to apply these methods to the teaching process is a high task for today's physics teacher.

The successful design of pedagogical technology and the guarantee of the final result (effectiveness) depends on the teacher's level of understanding of the essence of didactic issues and their ability to correctly assess them in the classroom. [6]

Defining a clear educational goal for each lesson is one of the most important conditions in the design of teaching technology. This defines the diagnostic purpose of science education.

Since the advent of physics as a science, the database of science has grown exponentially, and it is getting richer every year at a high rate.

Therefore, in the process of transitioning to physics, it is necessary to select only the necessary information and quantify the amount of data in accordance with the abilities of the student.

It is well-known that the human way of life and all the existing fields of science, technology and production cannot be imagined without electricity. At a time when the demand for electricity is growing, there are problems with its production. In particular, 86% of the country's electricity, ie a large amount of gas and coal, is used as primary fuel for the operation of thermal power plants with a total capacity of 10.6 million kW. Currently, the amount of raw materials that make up energy sources: coal, oil and gas is declining sharply. Experts estimate that if natural gas and coal are used at current levels, existing reserves could last for 20-30 years. This, in turn, necessitates the development of new innovative non-conventional energy sources and their widespread introduction into everyday life. In this context, the gradual formation of knowledge in this area, that is, the opportunities for efficient use of renewable energy resources, is important in the educational process. In this regard, we consider the possibility of forming fundamental concepts about non-conventional energy sources in the teaching of physics in secondary schools. It is known that the most common types of non-traditional and renewable energy sources are solar photovoltaic, wind energy, geothermal energy, and bioenergy. Solar photovoltaics is a non-traditional type of energy that is relatively convenient, efficient and environmentally friendly. The industry is currently developing mainly in the United States, Germany, Italy, Russia, Japan and China.[7]

The formation of data on solar photovoltaics covers more than one branch of physics, for example, the principle of operation of solar photovoltaic cells is based on the phenomenon of internal photoelectric effect, which converts solar optical radiation energy into electrical energy. When light strikes a semiconductor material, the electron pairs in the p-n junction are split in two. As a result, electricity begins to flow at the contacts formed in the solar photocells. This requires an explanation of the relationship between the optical and electrical branches of physics.[8]

Secondary schools should use as many basic concepts and information as possible, as well as simple, convenient and understandable information. As an example, the mechanisms of formation of p-n transitions in different elements depend on the type of element, as well as the quantitative characteristics of their sensitivity to external influences. Semiconductor elements use mainly silicon in solar photovoltaics. The elements (B) Boron or Phosphorus (F) are diffused in silicon to form a p-n junction. These elements also diffuse into the silicon element at different temperatures. During the lesson, such information should be shown in the schematic diagrams.[9] The use of animated visual aids in physics lessons is especially effective in shaping students' knowledge and skills. In this regard, it is more convenient and effective to develop knowledge, skills and competencies in students through the use of e-textbooks and animated visual aids in developing students 'knowledge and skills in solar photovoltaics. As an example, the process of animated visual representation of the p-n transition (potential barrier) of electrons and cavities in the phenomenon of internal photoeffects provides the reader with a clear idea of the subject. This will give you a clearer and more complete understanding of the nature of the laws of physics. There is a need to develop the physical and technological foundations of solar photovoltaics in the teaching of physics, taking into account the age of students and their scope of thinking. Today, the development of modern science and technology is bringing unprecedented discoveries and innovations in various fields of physics. Discoveries in the field of solar photovoltaics are also leading to the development of this field. In order to convey this information to the students, the teacher will have to find opportunities to make the teaching process interesting and effective, using the available opportunities and their pedagogical skills effectively. At the same time, the use of new innovative pedagogical technologies, non-traditional types of lessons gives positive results. It is a requirement of today's time to include in the teaching process of physics the technological base of renewable energy sources and information on the structure, principles of operation and use of photovoltaic devices in the teaching of physics in secondary schools.[10] In addition, the use of these suggested topics and information in physics clubs, independent work, and additional information will also yield positive results. Therefore, in the process of teaching physics, we see

that its laws, physical phenomena, and some other topics are related to solar photovoltaics. Table 1 below lists the devices that are recommended for use in the process of explaining school physics course topics:

Table 1.

T/r	Devices related to physics	Solar photovoltaic devices (Heliotechnical devices)
1	Heat transfer. Heat transfer methods	Solar boiler
2	Melting and solidification	Heliopechs. Helioys
3	Evaporation and condensation	Helioparniks
4	Humidity and its measurement	Helio dryers
5	Photo effect event	Solar panels

Of course, these links can also be used for extracurricular activities, such as club activities. In addition to topics, online materials, scientific journals, and other media can be used to explain concepts such as solar panels, solar panels, solar panels, solar panels, solar panels, and solar panels to students. As an independent learning tool to help students learn about alternative energy sources, they should also be helped to learn how to make crossword puzzles, interesting questions, and visual models.[11] It is useful for more students to search and study independently. In this context, there are opportunities to study the physical basis of traditional and non-traditional energy sources, modern constructions. Students will also develop knowledge, skills and competencies in alternative energy sources, particularly solar photovoltaics and their efficient use.

As physics progresses to the upper grades, the phenomena and laws become more complex, and the volume of teaching material increases. These and other similar parameters can negatively affect the quality of the lesson, the performance of students. To this end, the use of new pedagogical technologies in physics education has been found to be effective.[12]

The purpose of the use of new pedagogical technologies in physics education is to bring the student to the center of the lesson process, to develop independent and creative activity, to make students active participants in the lesson, away from memorization and voluntary repetition of learning materials.

The physics teaching process using the above new pedagogical technologies was also approved by the students. In contrast to the simple, traditional teaching process, the teaching process based on new pedagogical technologies has shown significant results.

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