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Research Article

INTEGRATION OF FUNDAMENTAL AND APPLIED CONCEPTS IN TEACHING ELEMENTARY CONCEPTS OF RENEWABLE ENERGY SOURCES IN THE COURSE OF PHYSICS

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ABSTRACT

This article introduces the formation of fundamental and practical concepts of renewable energy sources in physics education on the basis of interdisciplinary links, as well as methodological suggestions and recommendations on the choice of teaching materials on renewable energy sources on the basis of interdisciplinary links.

KEYWORDS

Energy source, integration of sciences, solar energy, knowledge, skills and competencies, fundamental knowledge, renewable energy source, interactive methods.

INTRODUCTION

The development of science and technology in the process of continuous education serves for the emergence of modern knowledge and the progress of sciences with constantly replenishing new information.

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From this point of view, many discoveries and innovations about the types of renewable energy sources and their modern designs are currently coming to science [1].

In the field of types of renewable energy sources and their use as an energy source, a lot of scientific and practical research has been carried out, and a huge amount of fundamental and practical knowledge has been created in this area.

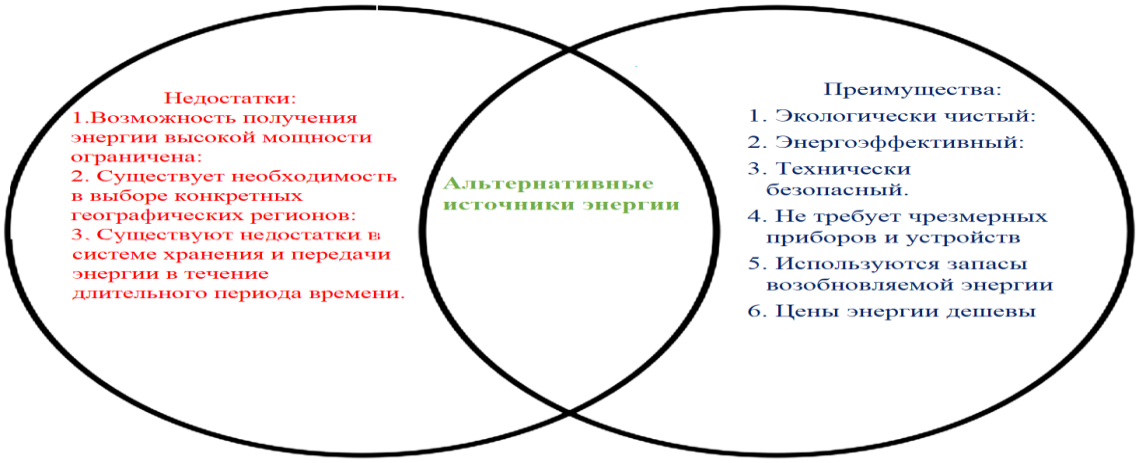
When developing this knowledge in the field of using renewable energy sources in the process of continuing education, there are several opportunities for using new pedagogical and information technologies.

In secondary schools, within the framework of teaching physics, a brief introduction to the types of renewable energy sources is given - only about the elements of solar technology and their use in solar energy.

From this point of view, it is advisable to methodically reorganize the sequence of simplified topics in accordance with the topics of school educational programs on the physical and technological foundations of alternative and renewable energy sources. Here, the effective use of modern teaching methods and techniques plays an important role. In the course of training, the advantages and disadvantages of alternative and renewable energy sources should be explained in detail, simply and clearly. The use of visual organizers and methods such as Venn Diagram, T-Chart, T-Table, Fish Skeleton, Lily Flower, Cluster is of great interest to students.

In this presented article for teaching in a physics course based on the integration of fundamental and practical knowledge, as an example, we would like to describe some methodological suggestions and recommendations about the types of alternative and renewable energy sources. As an example, in this presented article, we would like to describe some methodological suggestions and recommendations for teaching in a physics course based on the integration of fundamental and practical knowledge about the types of alternative and renewable energy sources.

Venn diagram



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When connecting fundamental knowledge about alternative and renewable energy sources with practical concepts, some difficulties can arise.

For example, discrepancy between theoretical calculations and practical results on the conversion of solar energy into electricity or often there are cases such as the discrepancy between the parameters measured in a physical phenomenon or process.

In such cases, for mutual convergence and correspondence between fundamental and practical concepts, it would be desirable to use additional values and simplifications.

In particular, the efficiency of silicon-based solar cells, according to theoretical calculations, is 25–30%; in heterojunction multilayer solar cells, this coefficient is 55–60%.

According to practical results, the fact that the efficiency in silicon-based solar cells is on average 17-22%, and in multilayer heterojunction solar cells is on average 40-45%, is presented in the results of many scientific studies.

These results will have to be explained on the basis of certain physical processes, technical and technological conditions. In this case, it is worth using complex materials to connect fundamental and practical concepts with each other. For example, based on the table below, this knowledge can be explained on the basis of generalized topics by linking to each other.

	Theme	Fundamental Concepts	Practical concepts	Integrated data
1	Solar cells and their working principles	Theoretical foundations for converting solar energy into electrical energy	Technological conditions for obtaining solar cells, their mechanical and chemical processing	The principle of operation of solar cells based on semiconductor materials and the technology of their preparation
2.	Solar panels and their modern designs	Processes of absorption of solar optical radiation in solar cells	Measurement and control of photovoltaic and electrophysical parameters of solar panels	Photovoltaic devices based on solar batteries: structure, principle of operation and effective use.

As can be seen from the table, it is necessary to explain fundamental and practical concepts related to renewable energy sources inextricably. Because, in the process of converting the energy of solar optical radiation into electricity, theoretical knowledge is supplemented by practical knowledge and this will lead to the formation of sufficient knowledge, skills and qualifications in the student related to the process of generating the resulting energy.

In general, the use of integrated knowledge in physics lessons, while simultaneously forming fundamental and practical ideas about alternative and renewable energy sources, can give a good result.

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