

## **IMPROVEMENT OF THE CONTENT OF PHYSICAL EDUCATION IN SECONDARY SCHOOLS USING TEACHING MATERIALS ON ALTERNATIVE AND RENEWABLE ENERGY SOURCES**

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### **ABSTRACT**

This article provides methodological guidance on the use of alternative and renewable sources of energy in school physics education for using in physics classes. The article also outlines the possibilities for using demonstration models and equipment in working out the knowledge, skills and qualifications of alternative and renewable sources of energy.

**Keywords:** Alternative sources of energy, visual aids, models, educational materials, solar house, knowledge, skills and qualifications, modern energy, interactive methods and techniques.

### **INTRODUCTION, LITERATURE REVIEW AND DISCUSSION**

It is well-known that human beings have the power to use lifelong energy and their effective, rational and efficient use is one of the most actual issues of present. In modern science and technology, energy resources are divided into two types, depending on the amount of raw materials, environmental impacts: traditional and alternative sources of energy [1, pp. 262-267]. There is a need for regular development on pupils the effective use of these modern types of energy, achievements and challenges, knowledge, skills and qualifications development on future prospective. Because it is impossible to imagine the human life without energy, i.e. without modern sources of energy. Although the concept of energy sources is provided perfectly at school physics course, its practical significance, types, laws, and the reasons for its occurrence have not been adequately reflected. This article discusses the opportunities of developing the content of knowledge on alternative and renewable sources of energy at the grades of 6, 8, and 9 of general school physics course. For this purpose, the materials on alternative physics and alternative sources of renewable energy were selected. Likewise, experimental and testing groups were identified from the same number of pupils. Practical implementation of the methodical and didactic manuals developed for the pedagogical experiment was carried out in selected experimental groups.

The pedagogical experiment was conducted at general educational schools № 5 and 9 of Termez district, Surkhandarya region, in the years of 2012-2018. Experimental tests were selected on the educational materials for the types of alternative and renewable sources of energy (see Tables 1, 2, 3) corresponding to themes at the grades of 6, 8, 9. The tables referring to the selection of alternative and renewable sources of energy in accordance with the themes covered in the program and introduce them to the lesson process. In addition, pupils have developed recommendations for use of demonstration models of working conditions to create adequate knowledge, skills and qualifications in alternative and renewable resources (tables).

Table 1.

<b>Using educational materials on alternative and renewable sources of energy in teaching physics at the grade of 6</b>			
<b>№</b>	<b>Subject program themes</b>	<b>Educational materials on alternative sources of energy</b>	<b>Visual aids and equipment</b>
1	Notion on work and energy	Initial notions on natural sources of energy	Presentation, videoclip, handouts
2	Energy types. Power	Types of alternative and renewable sources of energy	A3 formatted slides, pictures, crosswords
3	Devices producing heat. Heat reception	Types of thermoheat devices and their working principle	Geothermal device model, presentation, tests
4	Hard substance, transmission of heat in liquid and gases. Heat transmittance. convection	Usage of alternative sources of energy in heating the houses and producing heat	Thermo heat device model for use in the system of house heating
5	Radiation. Usage of heat transmittance in life and technique	Opportunities of usage of photoelectric and thermoelectric device in life and economic	Photoelectric device model, presentation, crosswords, handouts
6	Substance electrification	Physical laws of electric power production in solar elements	Sample of solar element, presentation, test and equations
7	Notion of electric power	Usage of electric energy as alternative and renewable sources of energy	Universal model of alternative sources of energy types
8	Significance of electric power in life. Simple electric chain	Opportunities of usage of mini solar photovoltaic device in life and in territories cut from energy	Mini photovoltaic device model, presentation, videoclip
9	Electric appliance at home. Saving electric energy	Usage of energy saving equipment and device at home	Energy saving lamps, electric chain, solar battery
10	Views of Beruni and Avicenna about light process	Physical basis of transforming light energy into electric energy	Presentation, handouts, videoclips

Table 2.

<b>Using educational materials on alternative and renewable sources of energy in teaching physics at the grade of 8</b>			
<b>№</b>	<b>Subject program themes</b>	<b>Educational materials on alternative sources of energy</b>	<b>Presentation, videoclip, handouts</b>
1	Notion of electric power	Physical mechanism of producing electric energy on the basis developing electron-hollow pairs	Electric chains and their schemes, diodes, transistors, resistors, presentation, videoclip
2	Power sources. Measuring electric power	Electric chains based on renewable sources of energy types, low powered solar battery	Solar elements based on silicon, different contact patterns, contact types
5	Electric power. Measuring electric power	Measuring features of semiconductor solar elements volt-ampere	Solar element samples, Ampère meter, voltmeter, connecting wire
6	Collecting electric chain, its electric power in different parts and measuring the power	Connecting solar elements one by one and parallel, measuring physical parameters	Videoclip, presentation, handouts
7	Electric power function. Electric energy and its calculation	Calculation of daily and annual energy use in one house using energy saving equipment (lighting, heating, hot water)	Mini thermoheating device model, presentation, videoclips
8	Electric heating equipment	Photothermo heating device and their functioning principles	Energy saving lamps, electric chain, solar battery
10	Power stations: Hydroelectric power stations, heating power stations, atomic power stations, windy power stations	Fundamental and applied notions of solar power stations, windy parks, biogas energy, geothermal energy, ocean and sea waves energy	Videoclips, presentation, handouts
11	Electric energy transmission. Powerful station. Electric transmission branch. Lowering station. Significance of electric energy.	Perspectives of usage of types of alternative sources of energy	Videoclips, presentation, handouts

Table 3.

Using educational materials on alternative and renewable sources of energy in teaching physics at the grade of 9			
№	Subject program themes	Educational materials on alternative sources of energy	Visual aids and equipment
1	Spread, return and break of the light	Utilization laws of light on the surface of solar element	Light source, solar imitator, presentation, videoclips, handouts
2	Full internal return	Ways and methods of decreasing light return factor on light photon energy and solar element surface, producing microunlevelness	Concentrated solar photovoltaic device model, slides, videoclips
3	Lenses	Solar photoelectric device based on phrenel lenses	Mini solar photovoltaic device model powered 6 kw, presentation
4	Optical equipment	Usage of optical equipment (energy saving greenhouses, LED lighting lamps) in increasing the utilization of semiconducted solar elements	Energy saving LED lamps, 60W accumulator battery, simple electric chain, house model based on 20W powered solar panel
5	Heliotechniques. Usage of solar energy in Uzbekistan and its perspectives	Modern constructions of heliotechnical device, technical opportunities usage of solar energy in Uzbekistan	Videoclips, presentations, handouts, crosswords, tests

Based on the themes presented in this table, there prepared visual demonstrative materials and equipment are required for use in teaching. For example, a model of “Solar House” was developed to explain the process of transforming alternative sources of energy into solar radiation. Because solar energy is the most effective among alternative sources of energy [2, p. 158]. Similar models, biogas device, geothermal energy equipment, wind power equipment models and electric chains have also been produced [3, p. 46]. Moreover, presentations on the types of alternative sources of energy were prepared. From websites on alternative sources of energy have been selected for the physical processes of generating each type of energy and videoclips of their practical implementation. Additional handouts, tests, crosswords, interesting questions and equations have been developed to effectively process of the lesson [4, p. 51]. In addition, A3 formatted pictures and tables have been prepared with illustrations of achievements and shortcomings in alternative, renewable sources of energy for use in life, industry and space research [5, p. 41]. Interactive methods and ways with display were selected for each theme to effectively conducting the teaching process.

The statistical analysis of experimental-testing is shown in the diagram below (Figure 1).

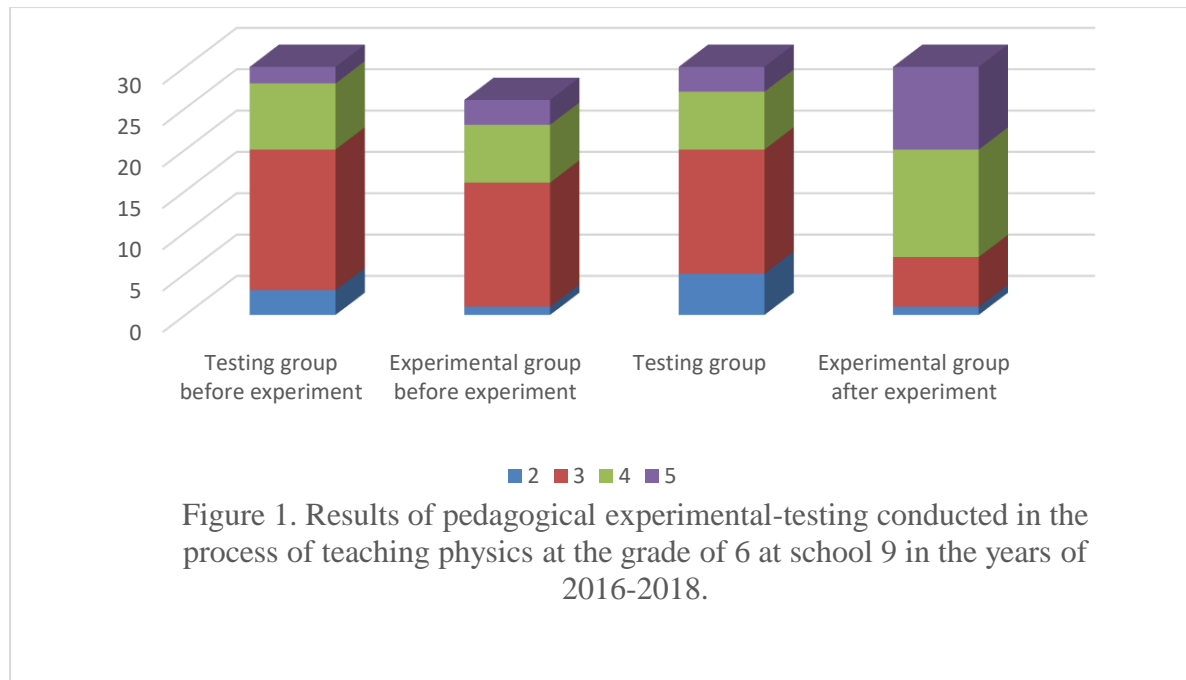


Figure 1. Results of pedagogical experimental-testing conducted in the process of teaching physics at the grade of 6 at school 9 in the years of 2016-2018.

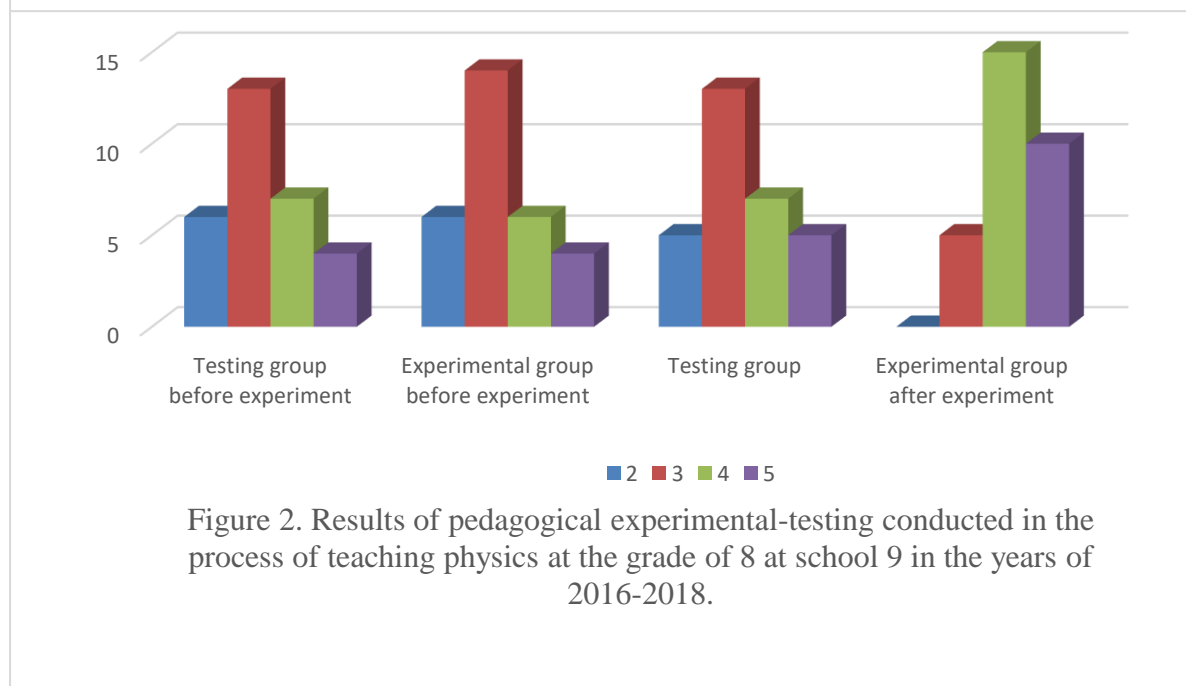
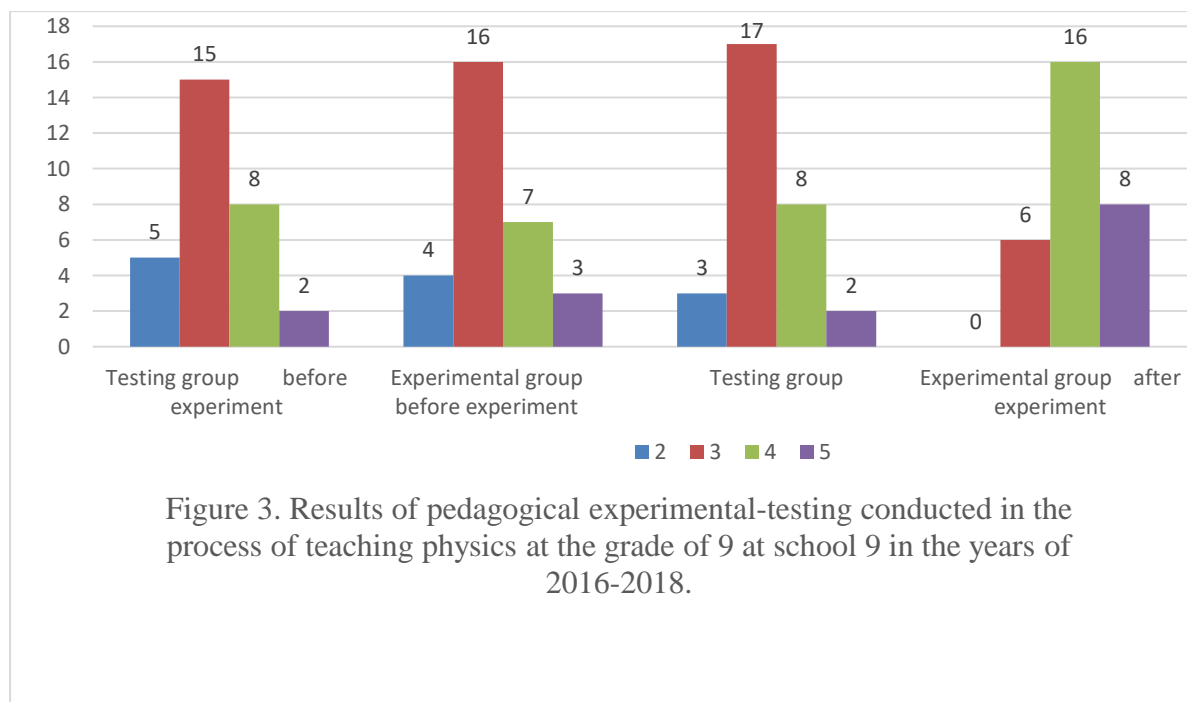


Figure 2. Results of pedagogical experimental-testing conducted in the process of teaching physics at the grade of 8 at school 9 in the years of 2016-2018.



According to statistical data, schoolchildren have enough knowledge, skills and qualification to learn alternative and renewable sources of energy. Each lesson in pedagogical experiments involves the formation of pupils' natural-scientific outlook, using their new pedagogical and information technologies to develop their designing and creativity skills. It has also been found that physics has the potential to increase the effectiveness of the course and to enrich its content through new teaching materials.

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