PEDAGOGICAL RESEARCHES AND THEIR RESULTS IN THE FORMATION THE SENSE OF KNOWLEDGE ON THE ALTERNATIVE ENERGY SOURCES IN SCHOOL PHYSICS EDUCATION

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ASBTRACT

This article describes pedagogical experiments on the possibility of forming alternative energy sources and knowledge of energy-saving technologies (circle, self-study, scientific-theoretical seminar, debates) in theoretical and practical classes in school physics education. Moreover, in the article given and analyzed the results of pedagogical experimental research on the development of scientific-creative and self-study activities on the basis of knowledge of alternative sources of energy and energy-saving technologies.

Keywords: School, alternative sources of energy, experiment-testing, circle classes, self-study, academic activity, designing skills, creative thinking, knowledge, skills and qualifications, modern knowledge, class effectiveness.

INTRODUCTION, LITERATURE REVIEW AND DISCUSSION

Initially, there were identified general educational schools needed for experiment-testing provision in organizing the experiment. The students of those schools were investigated and analyzed with the help of their physic knowledge, skills and qualifications, questionnaires and testing, written work, oral quizzes. In order to ensure the results of the experiment are accurate, the pupils in the educational institutions with equal physic education have been selected. The schools #5 and #9 of Termez district of Surkhandarya region were selected for the experiment. The members of scientific and educational circles on physics of above-mentioned schools were also involved in the experiment-testing.

The main purpose of the experimental research is to provide the general educational schools with theoretical and practical lessons and the development of methodological guidelines for teaching the content of alternative energy sources during the physics education process, as well as various non-traditional methods and techniques of teaching pupils and multimedia educational facilities. All necessary educational and practical materials on teaching the content of alternative energy sources have been developed for the pedagogical experiment. In physics, the views on alternate sources of energy in physics in curriculum and programmes were discussed, and the recommendations of the teachers were analyzed.

Numerous studies are being conducted on the use of alternative energy sources and their wide use [2-4]. That's why our pedagogical experiments play an important role in the teaching of physics.

Pupils' knowledge, skills and qualifications were studied in written, oral, testing and evaluated with "excellent", "good", "satisfactory" and "unsatisfactory" marks. To ensure the results of the experiment to be accurate, schoolchildren were selected in equal numbers (experimental and

control groups and classes). It was emphasized the importance of that one teacher had to teach in experiment and control groups and supervise the circle classes as well as. The aim of the experimental work is to provide pupils with an opportunity to develop knowledge, skills and qualifications through organizing theoretical and practical lessons on alternative energy sources and energy saving technologies, non-standard, independent creative thinking, design and development skills, to determine the effectiveness of the required methodological and didactic learning outcomes. Theoretical justification and practical application of the acquired knowledge during the classroom and circle classes have been confirmed. As a result, the results obtained for the pedagogical process were studied and conclusions were drawn. The process of experimentation was the preparation of written works, tests, problem solving exercises, and analysis of responses from the pupils. Particular attention was paid to the fact that the research work could be achieved through theoretical and practical classes in physics, as well as in the circle sessions of the knowledge system needed to study the knowledge of alternative energy sources.

Secondary schools on alternative energy sources and energy saving technologies were analyzed by using χ^2 statistical criteria to determine the reliability of the results of pedagogical practice in physics education and to demonstrate the effectiveness of the proposed methodology. Recommendations from the book by M.I.Grabar and K.A.Krasnyanskaya ("The use of mathematical statistics in pedagogical research " - M .: Pedagogika, 1977) were used [1]. The value of the statistical criterion

$$T = \frac{1}{n_1 n_2} \sum_{i=1}^{C} \frac{(n_1 O_{2i} - n_2 O_{1i})^2}{O_{1i} + O_{2i}} \qquad (1)$$

was calculated based on the formula.

Here n_1 is the number of pupils in the experimental group, n_2 is the number of pupils in the control group, and the number of evaluations of O_{1i} and O_{2i}, respectively, in the control and experimental groups. χ^2 criteria for evaluating the results of experimental research and experimental group students, based on 4 types of assessment, i.e. the number of categories is C=4. If the level of significance is α=0.05 it is equal to ν=C-1=3, T_{kr}=7,81 is taken from the table χ^2. We write (1) for 4 types of evaluation of the formula

$$T = \frac{1}{n_1 n_2}\left\{\frac{(n_1 O_{21} - n_2 O_{11})^2}{O_{11} + O_{21}} + \frac{(n_1 O_{22} - n_2 O_{12})^2}{O_{12} + O_{22}} + \frac{(n_1 O_{23} - n_2 O_{13})^2}{O_{13} + O_{23}} + \frac{n_1 O_{24} - n_2 O_{14}}{O_{24} + O_{14}}\right\} \qquad (2)$$

According to the formula (2), at the beginning of the academic year 2014-2015, we calculated the results of pupils' knowledge (by chart No.1) as follows:

$$T = \frac{1}{120 \cdot 120}\left\{\frac{(120 \cdot 23 - 120 \cdot 21)^2}{21 + 23} + \frac{(120 \cdot 48 - 120 \cdot 44)^2}{44 + 48} + \frac{(120 \cdot 37 - 120 \cdot 42)^2}{42 + 37} + \frac{(120 \cdot 12 - 120 \cdot 13)^2}{13 + 12}\right\} =$$

$$= \frac{1}{14400}\left\{\frac{(2760 - 2520)^2}{44} + \frac{(5760 - 5280)^2}{92} + \frac{(4440 - 5040)^2}{79} + \frac{(1440 - 1560)^2}{25}\right\} = 0.62$$

Since the result of the calculation is $\boldsymbol{T = 0{,}62 < T_{kp} = 7{,}81}$, zero hypothesis is accepted. It can be seen from the fact that the level of knowledge acquired in pre-experimental studies in the selected groups is almost the same. Similar calculations will be made on the basis of the results of pre-experiment testing tasks:

$$T=\frac{1}{120\cdot 120}\left\{\frac{(120\cdot 29-120\cdot 16)^2}{16+29}+\frac{(120\cdot 59-120\cdot 51)^2}{51+59}+\frac{(120\cdot 26-120\cdot 39)^2}{39+26}+\frac{(120\cdot 6-120\cdot 14)^2}{14+6}\right\}=$$

$$=\frac{1}{14400}\left\{\frac{(3480-1920)^2}{45}+\frac{(7080-6120)^2}{110}+\frac{(3120-4680)^2}{64}+\frac{(720-1680)^2}{20}\right\}=10.2$$

Calculations as above were also carried out for the academic years of 2015-2016, 2016-2017 and 2017-2018. The results of the experiment start were shown in Table 1 and by chart figure 1,2 and the results at the end of the experiment are shown in Table 2 and by chart figures 3 and 4.

Table 1.Distribution of pupils according to assessment in experimental and control groups (pre-experiment indicators)

Academic year	Number of pupils	Experiment group				Number of pupils	Control group			
		Types of assessment					Types of assessment			
		excellent	good	satisfactory	unsatisfactory		excellent	good	satisfactory	unsatisfactory
2014-2015	120	23	48	37	12	120	21	44	42	13
	%	19,2	40	30,8	10	%	17,5	36,7	35	10,8
2015-2016	120	20	52	38	10	120	19	49	40	12
	%	16	43,3	31,7	8	%	15,8	40,8	33,3	10
2016-2017	120	21	55	31	13	120	22	46	39	13
	%	17,5	45,8	25,8	10,8	%	18,3	38,3	32,5	10,8
2017-2018	120	24	49	36	11	120	20	47	41	12
	%	20	40,8	30	9	%	16	39,1	34,1	10
Total	480	88	204	142	46	480	82	186	162	50
	%	18,3	42,5	29,6	9,6	%	17	38,7	33,7	10,4

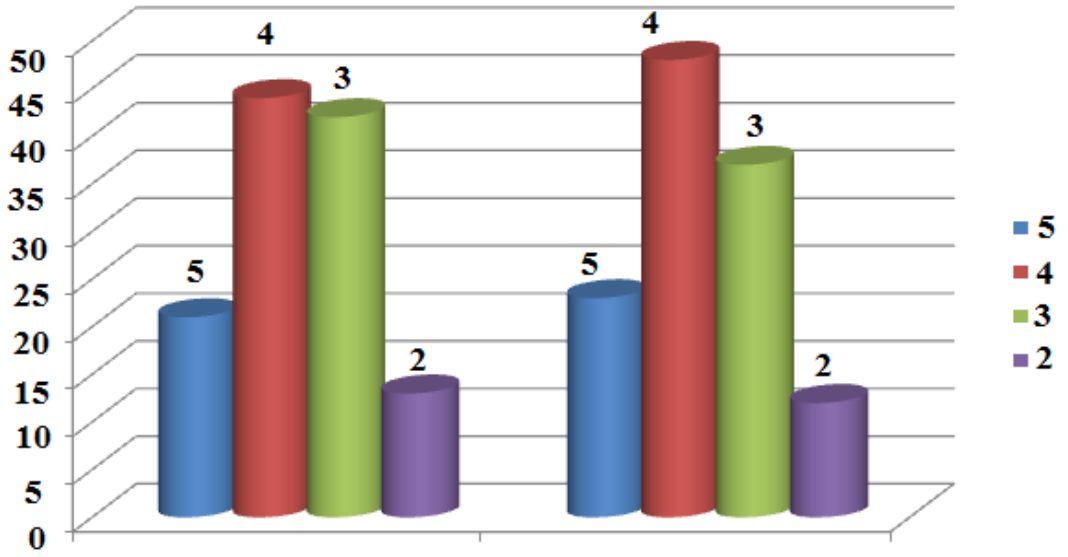
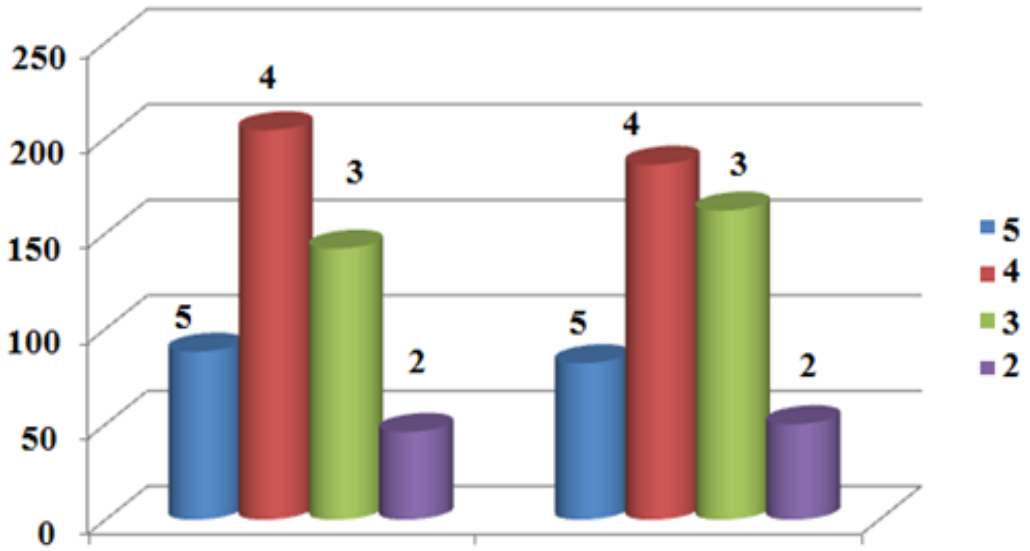


Figure 1. The chart of pre-experimental test results in academic year of 2014-2015.



Experiment group Control group

Picture 2. The chart of pre-experimental test results for the academic years of 2014-2018.

The knowledge and control results of physics education circle members carried out on the basis of our recommendation in the zero hypothesis do not have any effect. Therefore, the difference in results was not statistically significant, that is, randomly assumed. However, the results of experiments are confirmed by the zero hypothesis. Consequently, our recommendations have led to statistically significant results.

The results of the experimental testing show that students are interested in quantitative assessment of the content of physics self-study. This, in turn, confirms the effectiveness of our research and the reliability of our recommendations in pedagogical terms (Table 2). The results of the experimental results summarized the results obtained in the statistical study and have described one study for four academic year (Figure 4). This was also seen as evidence of the superiority of the method used in experimental groups.

Table 2. Evaluation results in experimental and control groups.

Academic year	Experiment group					Control group					T-observation
	Number of pupils	Types of assessment				Number of pupils	Types of assessment				
		excellent	good	satisfactory	unsatisfactory		excellent	good	satisfactory	unsatisfactory	
2014-2015	120	29	59	26	6	120	16	51	39	14	10,2
	%	24,1	49,2	21,6	5	%	13,3	42,5	32,5	11,7	
2015-2016	120	30	56	27	7	120	14	50	43	13	11,6
	%	25	46,6	22,5	5,8	%	11,7	41,6	35,8	10,8	
2016-2017	120	29	60	23	8	120	19	49	38	14	8,5
	%	24,1	50	19,1	6,8	%	15,8	40,8	31,6	11,7	
2017-2018	120	32	58	25	5	120	18	52	39	11	9,6
	%	26,8	48,4	20,8	7	%	15	43,3	32,5	9,1	
Total	480	120	233	101	26	480	67	202	159	52	-
	%	25	48,5	21	5,5	%	13,9	42	33,3	10,8	

The following results were obtained for the T-statistical observation of calculations:

$T_{obs} = 10,2$; $T_{obs} > T_{krit} = 7,81$ (2014/2015)
$T_{obs} = 11,6$; $T_{obs} > T_{krit} = 7,81$ (2015/2016)
$T_{obs} = 8,5$; $T_{obs} > T_{krit} = 7,81$ (2016/2017)
$T_{obs} = 9,6$; $T_{obs} > T_{krit} = 7,81$ (2017/2018)

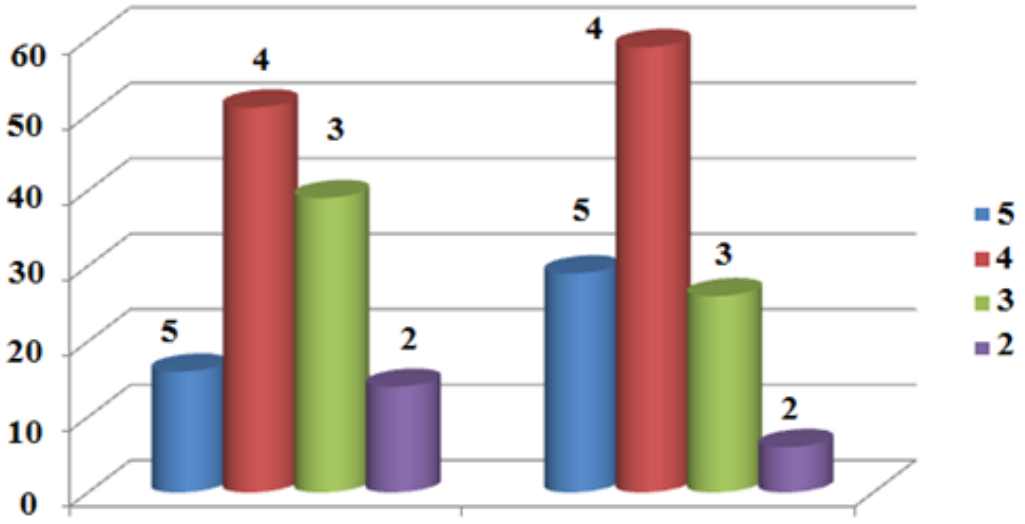


Figure 3. The chart of experimental testing results in the academic year of 2014-2015

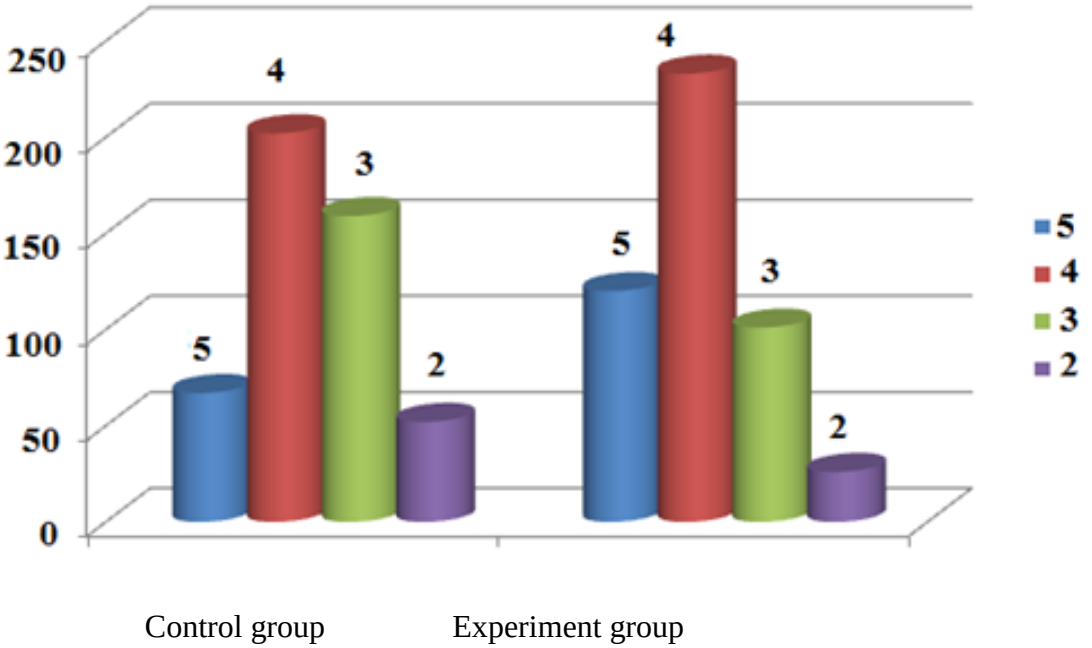


Figure 4. Experience test results chart for the academic years of 2014-2018.

The results of the experimental testing studies and their analysis:
- pupils have learned modern knowledge and skills in the field of alternative energy sources during their lessons, scientific-seminar and circle classes; they have created and developed scientific and creative, independent work, design skills and abilities for their alternative sources of energy;
- throughout the course, pupils have creative thinking, independence, creativity, dedication, enthusiasm, increased activeness, concluding, self-esteem;

- resulted in the formation of academic-creative outlook, independent thinking and the formation of modern knowledge on the basis of new pedagogical and information technologies on the basis of the right organization of curricular activities for the students to understand the fundamental and practical concepts of alternative energy sources, as a result of which effectiveness of lessons and circle classses it has justified the conclusions that it has increased [5].

The results of experimental testing studies conducted in general education schools have led to the following conclusions:

1. During the lesson and extracurricular activities, the students learned about the latest science and technology news, such as the types of alternative energy sources and their modern designs, their future prospects, relevance, and the development of scientific, creative, and constructive skills of alternative energy sources, independent creative work skills were developed in this area.
2. During the classroom, pupils were given the opportunity to scientific-creative thinking, independent researching, witty, scientific-researcher, increase their self-esteem, motivation, intellectual activity.
3. The culture of effective, rational and economical use of energy-efficient technologies has been shaped in pupils' lesson processes. This leads to energy saving opportunities in the development of state and society. The results of experimental and testing trials demonstrate the effectiveness of methodological developments in teaching physical education through the proposed alternative sources of energy.

REFERENCES

1. Grabar M.N., Krasnyanskaya K.A. The use of mathematical statistics in pedagogical research. // Nonparametrical methods. - M .: Pedagogy. 1977. P.136.
2. G. M. Masters Renewable and Efficient Electric Power Systems. M.: Oxford University Press, 2010. – 545 P.
3. R.V.Gorodov., V.E.Gubin, A.S.Matveev. Unconventional and renewable energy sources. Tutorial. - Tomsk .. - Publishing House of TPU. - 2009. - 294 s.
4. V.Germanovich, A.Turilin. Alternative energy sources and energy saving. Practical designs for the use of wind, sun, water, earth, biomass.-SPb .: Science and Technology, 2014. p. 320.
5. Abdiev U.B. Elementary concepts of solar photovoltaics in school physics education and technology of their teaching. Methodical brochure. "Turon-Iqbol", Tashkent. 2017. P.35.