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THE ROLE OF PEDAGOGICAL TECHNOLOGIES IN INCREASING THE EFFICIENCY OF PHYSICS TEACHING

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Abstract
The article presents the application of the use of Venn diagrams in the teaching of physics lectures. In this, the characteristics of the wave nature of light and the characteristics of the particle nature are explained through the Venn diagram, and the efficiency coefficient is determined.

Keywords: pedagogical technology, Venn diagram, wave and partial nature of light, confidence interval, average cost, efficiency

INTRODUCTION

The application of pedagogical technologies to the educational process is of great importance in increasing the effectiveness of the quality of education.
Pedagogical technology is an educational activity that is organized on the basis of a specific project, looks at the educational process as a set aimed at a specific goal, and takes a technological approach to the educational process that guarantees the results of this goal. The use of pedagogical technologies in the teaching of lectures on physics serves to increase the effectiveness of the quality of education.

Literature Analysis

One of the interactive educational technologies is graphic organizers, and this method is considered the most popular technology. Considered one of the graphic organizers, the Venn diagram was introduced in 1880 by John Venn in the Philosophical Magazine and Journal of Science in an article titled "On the Diagrammatic and Mechanical Representation of Propositions and Reasonings" [1] about various ways of representing propositions by diagrams[2,3]. The Venn diagram has been used in the educational process until now in the teaching of English [4], in the training of pedagogues [5], in the teaching of mathematics [6]. However, this method has not been sufficiently researched in the teaching of lectures in physics. In this work, the

use of the graphic organizer Venn diagram in the teaching of topics related to the optics department and the quantum properties of light is shown.

Research Methodology

The purpose of using the "Venn diagram" method is to form students' skills in comparing two or more subjects and concepts, identifying their differences and common aspects. In this method, the teacher can directly explain the lectures on the topic, or the students can fill in the Vennas independently in groups. This, in turn, ensures that students actively participate in the lesson. In the course of the training, experimental-test groups were lectured on subjects related to the optics department using Venn diagrams. In the control groups, training was conducted without using the Venn diagram. The application of the Venn diagram to physics lectures is shown in Figure 1.

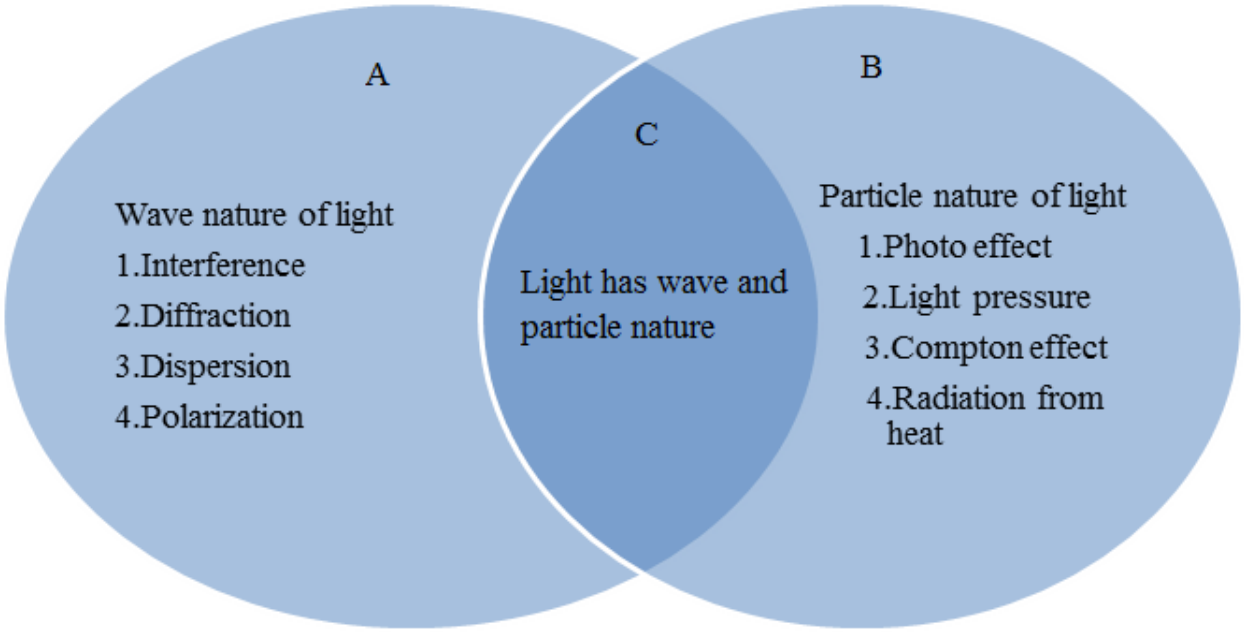

Figure 1. Comparison of properties characteristic of wave and particle nature of light

Part A of the diagram in Figure 1 illustrates the wave (electromagnetic) nature of light. It is shown that the phenomena of interference, diffraction, dispersion and polarization have the wave nature of light. Students should fill in the spaces for each of the above phenomena and prove that these phenomena are waves. The teacher can explain each phenomenon to the students using these sentences.

Part B of the diagram shows the particle (quantum) nature of light. It shows the photoeffect, light pressure, Compton effect, and radiation from heat, proving the particle nature of light. In this case, the students dwell on each phenomenon and

prove that it has a particle nature. The teacher can explain the particle nature of light using a venn diagram.

Part C of the diagram analyzes, compares and summarizes the fact that light has both a wave (electromagnetic) and a particle (quantum) nature. In this, the particle and wave nature of light is analyzed, compared and their common aspects explained by the students. Both wave and particle nature of light are analyzed and compared by the teacher.

Light acts on some devices like a wave, and on others it acts like a corpuscle. Therefore, it is not necessary to contrast the wave and corpuscular properties of light observed in experiments. Perhaps it should be considered that light has both properties at the same time. In other words, a dialectical unity of wave and corpuscular properties is observed in electromagnetic radiation.

Most of the information about electromagnetic radiation, especially light, is created indirectly with the help of special devices, not through the direct sense organs of a person. However, these properties are manifested on the basis of a certain law: with decreasing wavelength (increasing frequency), corpuscular properties of electromagnetic radiation become more apparent. On the contrary, due to the increase in wavelength (decrease in frequency), the wave properties of electromagnetic radiation begin to emerge. According to de Broglie's hypothesis, corpuscular wave dualism applies to both electromagnetic radiation and matter particles. In that case, the following relationship, which is appropriate for a photon of electromagnetic radiation, can be applied to particles of matter as well. Therefore, it is concluded that during the movement of a particle with mass m and speed v (that is, momentum P=mv), the properties of a wave with a length $\lambda = \frac{h}{P} = \frac{h}{mv}$ must be manifested.

Analyzes and Results

We present the analysis of experimental test works.An experimental group and a control group were formed in this study.58 students were selected for the experimental group and 60 students for the control group.The results of the control tests on topics related to the optics department are given in Table 1-2.

Table 1

Groups	Number of students	Amount of grades			
		“2”	“3”	“4”	“5”
Experience is a test groups	58	2	9	21	26
Control groups	60	12	21	17	10

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The statistical analysis of the results of this section is presented in the table below.

Table 2

	Experimental group	Control group
Grade value	5 4 3 2	5 4 3 2
Number of matching grades	26 21 9 2	10 17 21 12
Arithmetic mean value of grades	$x_t^* = 4.13$	$x_n^* = 3.33$
Efficiency coefficient	$\eta = \frac{x_t^*}{x_n^*} = 1.24$	
X's credibility interval	$4 < x_t^* < 4.44$	$2.95 < x_t^* < 3.89$

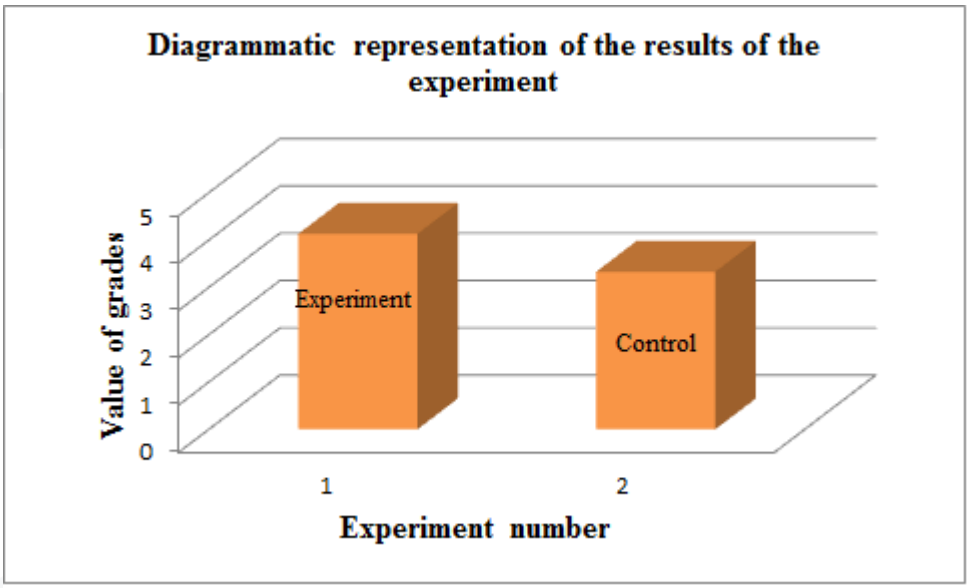

Figure 2. Diagrammatic view of the experimental results.

Conclusions

In short, the confidence interval of the assessment according to the Student's criterion for the department of optics was determined with a probability of 0.95.The coefficient of effectiveness in teaching subjects of the Department of Optics is equal to 1.24.As a result, it can be seen that the effectiveness of using Venn diagrams in teaching physics lectures is higher in the experimental group.

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