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Teaching optics to primary school children

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Abstract

A course of very elementary optics, that can be given to primary school children as an additional course to the regular compulsory program, is developed. The course contains explanation of the most basic phenomena existing around us, which involve light. As well as considers principles of operation of basic optical elements and more complicated devices (microscopes, telescopes, lasers). All these phenomena and devices are explained in a very simple way and are demonstrated in simple experiments, that makes them understandable to primary school children. This course is intended to help young children to develop a “physical” way of thinking.

Keywords

primary school education, elementary optics

Summary

Education programs in elementary physics for regular secondary schools are often very poor. And that means that the majority of people (except those who continue their education in physics-related areas) get a poor understanding of the physical world around them. And even those who continue their education in physics often don't understand physical phenomena they deal with in their everyday life, because educational programs in colleges and universities do not include any topics in elementary physics. This would hold for optics in particular too. And as a result even scientists with advanced degrees in physics may often be unable to answer such simple questions as, for example: *Why the sky is blue?* or *Why a rainbow appears on the sky?*.

Another serious problem is that nowadays scientists tend to lose the “physical” way of thinking. Under this “physical” way of thinking we mean the way when a person understands the phenomenon basically, and then uses mathematics and other modern resources to describe and explain it accurately. Unfortunately nowadays scientists tend to demonstrate a reverse behavior. They are often very able in operating complicated mathematical equations but fail in being able to explain the essence of the phenomenon in simple words.

As an option that could help to solve these problems we suggest a course of very elementary optics, that can be given to primary school children as an additional course to the regular compulsory program.

The course contains explanation of the most basic phenomena existing around us, which involve light. We start from explaining what is white light and why we see different colors. We consider the role of sun as a main source of light and explain different phenomena, such as moonlight, phases of moon, solar eclipse. We explain the appearance of shadows and describe how people were using this effect in early history (sun clocks for instance). We describe effects taking place during light propagation, reflection and absorption. Principles of operation of basic optical elements – prisms, lenses, mirrors, filters - are explained and demonstrated in simple experiments. We also describe operation of more complicated

devices, such as microscopes and telescopes. We even try to explain in a simple way so relatively complicated phenomena as interference and diffraction, describe principles of operation of lasers, basic principles of holography and adaptive optics. All these phenomena and devices are explained in a very simple way that makes them understandable to primary school children. At the end of the course we suggest a specially developed test containing questions which were not discussed during the course but which can be answered basing on the knowledge obtained by children.

Why this program was developed especially for primary school children? First of all children of this age still continue, but are not yet embarrassed to ask the fundamental question *Why...?*. And also such a simple way of explanation used for very young children can result in two main outcomes: first, these children from a very young age learn and understand basic phenomena in nature around them. But also this way of thinking may help to develop the need of deep understanding of basic principles, that can be important both for their future education, as well as for the rest of their lives, forming gradually a more educated person having deeper insight into surrounding phenomena.