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Natural sciences creation role

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ABSTRACT

The phenomenal world has always been and remains a research intrigue, both in the natural and in the social sciences. The human ability to recognize laws in the phenomenal world and to direct them towards the area of practical application of science leads to technical creativity. From the historical point of view, natural sciences were only classified as sciences that dealt with material things of inanimate nature. However, the natural sciences are sciences dealing with the animate and inanimate nature. Traditional areas of natural sciences –physics, chemistry, biology and geology – are still marked by a widespread general idea regarding natural sciences. The aim of this work is to contribute to identifying the area of natural science education impact on human inventiveness and creativity in the field of human activity.

Keywords: natural sciences, creation, aplicattion, examples.

Introduction

The phenomenal world has always been and remains a research intrigue, both in the natural and in the social sciences. The human ability to recognize laws in the phenomenal world and to direct them towards the area of practical application of science leads to technical creativity. From the historical point of view, natural sciences were only classified as sciences that dealt with material things of inanimate nature. By existing in the phenomenal world, the qualities impact the environment. As a measure of resistance to change, mass has a gravitational effect on the environment. Alongside mass, the quality present in elementary particles: charge, electric charge, appears in two forms, plus-minus pairs. Thus, in the process of separating electrification, they are neither created, nor destroyed, but moved from one place to another.

All the while, the overall electrification remains a constant. In that regard, one can say there is a universal law in nature that can be formulated as follows: The overall (system) electrification is constant in all the processes. Universe is neutral. In order to separate electrification, energy has to be applied. Quantitative domination of one, affects the environment - the electric field. Natural sciences, primarily physics study the two mentioned fields. But, by analysing the phenomenal world we detect quality that is usually called life. The presence of this quality in the material world also affects the environment, which is expressed in the analysis of human behaviour. The field of love... The quality and quantity of this expression including relations are attributed to social sciences. The knowledge belonging to the material world reaches human beings in a greater or lesser degree. The way and quantity of this knowledge a human adjusts to humane living depends upon the individual's or ingenuity of the group, i.e. the quantity of creation they introduce based upon the familiar natural laws is up to the human.

Natural sciences

Natural sciences reflect knowledge in the phenomenal world of nature through description, apprehension of natural phenomena based upon observation, as well as empirical evidence. By establishing laws in a mathematical way, the flow of natural processes can be foreseen. Therefore, first comes the phenomenon hypothesis and then the experiment refuting or supporting the hypothesis on the process, i.e. laws of the natural process. To put it precisely, repetition of the observation results during an experiment can ensure the validity of scientific discovery.

Simply divided, natural sciences can be viewed as life and physical sciences with "still life" being the latter's object of study. Physical science can be divided into branches, including physics, astronomy, chemistry and geoscience. Of course, the division does not

end there. Natural sciences are branched out into specialised scientific fields of study. Technique is the practical application of science. Owing to the progress natural sciences have made, human lifespan has increased, life is more pleasant, it is safer and more beautiful due to creations made by human ingenuity. Creation has arisen through knowledge about the laws of nature. In fact, in the last letter he wrote to his mother, Nikola Tesla states "...mother, until all the lightbulbs in the senate shone, I thought I had created electricity, but then I realised it existed beyond and before me... It was only "given" to me to publish it to humanity... Technology offers the process beginning with science and technique and ending with a knowledge applicable in practice.

These three factors; science, technique and technology provide a comfortable life to a society through ingenuity of humans and their creations. There are laws - science, their application is technique and the way they are demonstrated - technology.

Creation

Creation or creativity is the ability to produce something new by way of imagination, whether it is a new solution, method... This term is usually related to the abundance of ideas and original thinking, as well as the practical application of the work done. Broadly speaking, creation or creativity is seen in a human's ability to think and behave through which they make changes in this world, as well as change themselves. Creation or creativity is generally seen in a human's ability to self-actualise in the surrounding world through constructive and productive reasoning and behaviour by way of making changes in the world and changing themselves. Creation and creativity are significant levers in the general development of a society. Technical creation makes a special contribution to the development of a society. It is reflected through practical application of physical laws on technical advances.

Examples of technical solutions

A great number of technical creations represent a consequence of discovering physical processes and laws regarding them during physics lectures.

Temperature based body geometry

Through constructive ingenuity and finding that body geometry depends on its temperature and the thermal properties analysis of different materials, the person who attends the lecture arrives at the constructive material called reinforced concrete. The concrete itself has defined mechanical properties which could be improved by using additional construction. But, to make a material compatible, one must look into its thermal properties. The table shows that concrete and iron have the same thermal expansion coefficient. There is no shearing when the temperature is changed. Reinforced concrete is the idea!

Table 1: Solid and liquid materials' coefficient of thermal expansion

	Coefficient of Thermal Expansion $(C°)^{-1}$	
Substance	Linear (α)	Volume (β)
Solids		
Aluminum	23×10^{-6}	69×10^{-6}
Brass	19×10^{-6}	57×10^{-6}
Concrete	12×10^{-6}	36×10^{-6}
Copper	17×10^{-6}	51×10^{-6}
Glass (common)	8.5×10^{-6}	26×10^{-6}
Glass (Pyrcx)	3.3×10^{-6}	9.9×10^{-6}
Gold	14×10^{-6}	42×10^{-6}
Iron or steel	12×10^{-6}	36×10^{-6}
Lead	29×10^{-6}	87×10^{-6}
Nickel	13×10^{-6}	39×10^{-6}
Quartz (fused)	0.50×10^{-6}	1.5×10^{-6}
Silver	19×10^{-6}	57×10^{-6}
Liquids		
Benzene	—	1240×10^{-6}
Carbon tetrachloride	—	1240×10^{-6}
Ethyl alcohol	—	1120×10^{-6}
Gasoline	—	950×10^{-6}
Mercury	—	182×10^{-6}
Methyl alcohol	—	1200×10^{-6}
Water	—	207×10^{-6}

Refraction of light

When light propagates through two mediums with different optical densities, the direction in which it spreads out is changed - a phenomenon known as refraction of light. This phenomenon occurs at the boundary between the mediums as a consequence of the change in the speed of light. The incident and refracting waves, as well as the perpendicular to the boundary surface are at the same level.

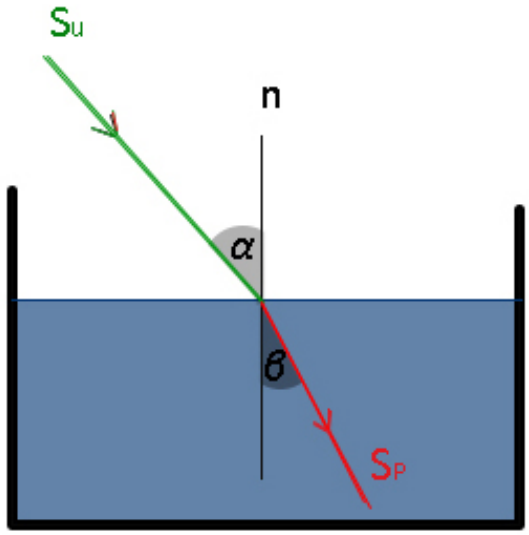

Figure 1: Refraction of light "towards the normal" when passing from an optically less dense to a more dense medium

If the light propagates from an optically less dense to a more dense medium (for example from air into water), the incidence is larger than the refraction angle - light refracts towards the normal. Optical density provides information regarding the speed of light and is determined by a refractive index. The refractive index shows how much greater the speed of light is in a vacuum as opposed to the observed medium (n is always greater than 1, which shows that the speed is greatest in a vacuum).

The change in direction is shown through the law of refraction (sine of incidence / sine of refraction is the same as the other medium index ratio in relation to the first one n_2/n_1). The refractive index describes the optical properties of the substance. It is concluded that, by propagating from a medium with a higher refractive index, lesser speed, and greater optical density into a medium with a lower refractive index, greater speed and rarer optical density one can create a condition in which the light returns to the same medium. Total internal reflection!

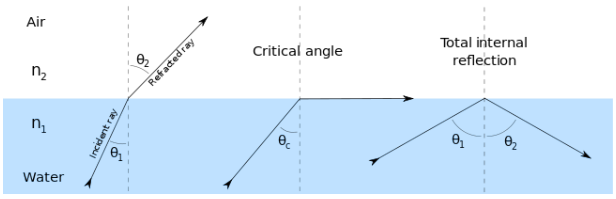

Figure 2: Alongside the notion of total internal reflection

Therefore, when light propagates from a medium with a lesser speed into a medium with a greater speed the conditions of the total internal reflection phenomenon will be fulfilled. Optical fibre idea! An optical fibre is usually made out of glass or plastic and serves for transmitting information by using light. Optical fibres are placed in an optical fibre cable. As a medium, optical fibres are much faster, more reliable and safer than copper conduits because they do not transfer electrical, but light signals. That is why it is impossible to have an unauthorised access to the network via radio frequency interference (RFI) and electromagnetic (EMI) interference. The core is optically denser (a higher refractive index; lesser speed of light), and the cladding is optically rarer (a lower refractive index; greater speed).

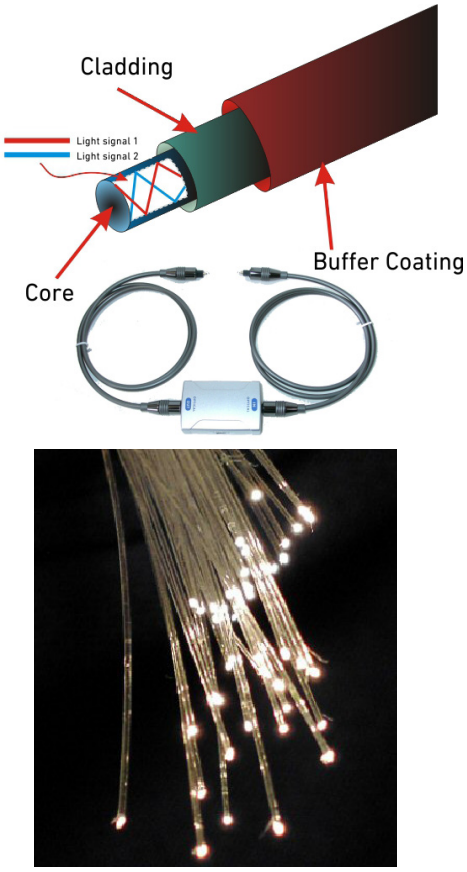

Figure 3: A data transmission optical fibre

Photoelectric effect

The photoelectric effect is the emission of electrons from metals under the effect of light. It was accidentally discovered by Hertz in 1887. Before Einstein physicists were confused by the fact that more light emanates more electrons but does not change their energy. Colour (wave length), not light intensity, affects the energy of electrons. Therefore, light energy separates the negative from the positive electric charges! Einstein solved all the dilemmas in 1905 by hypothesising that light is composed of particles, i.e. it is spread through quanta called photons. More photons emanate more electrons, but the electron energy can only grow if the photon energy grows too. Einstein's hypothesis was so radical that even Planck, the originator of quantum theory, opposed it. In 1921 Einstein was awarded the Nobel Prize in Physics for explaining the photoelectric effect $hf = A_i + E_k$.

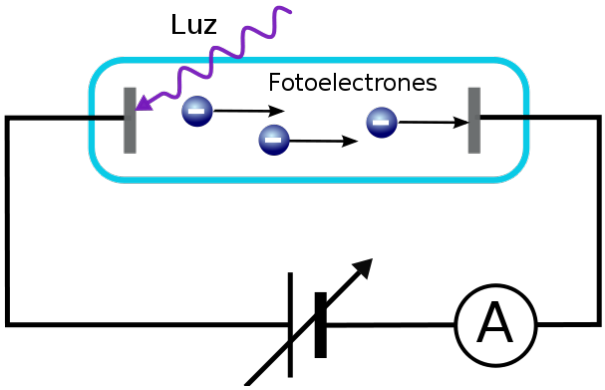

Figure 4: The phenomenon of photoelectric effect

The interaction of photons and materials resulted in inventing photovoltaic cells! In other words, light energy creates electrical energy! The possibility to transform free solar energy into elegantly usable electrical energy arose...

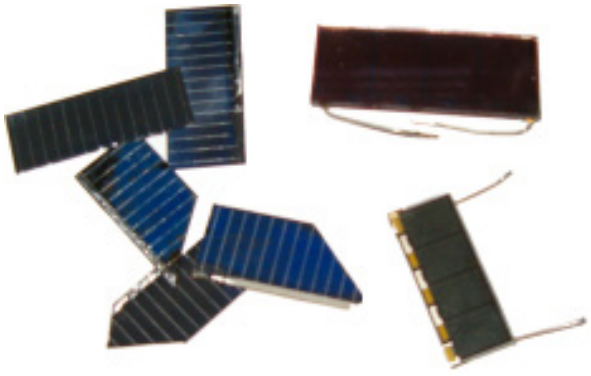

Figure 5: Idea of a photoelectric cell

Frictional electrification

When rubbed, a body becomes electrified and attracts small particles. The mechanical energy is transmitted into electrified bodies by friction. This knowledge developed a thought regarding its usage.

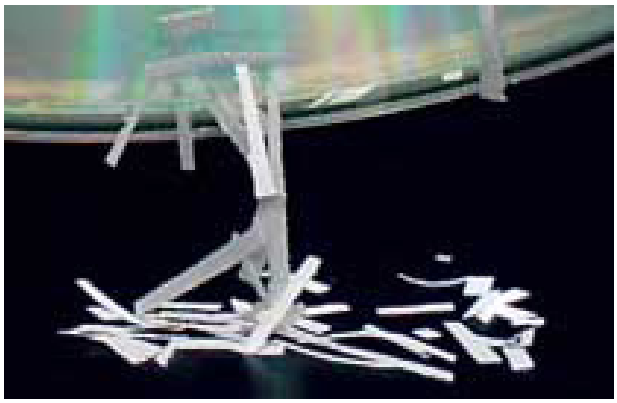

Figure 6: When rubbed, a CD attracts paper, dust, etc.

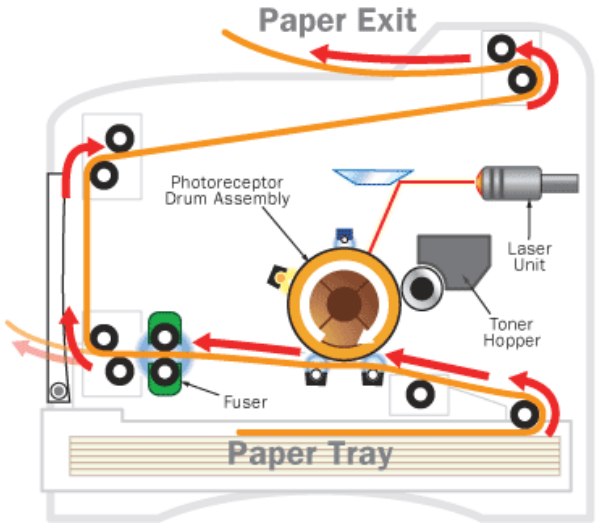

Figure 7: The photocopier structure

Ingenuity gave us the photocopier! It could take a long time to list all the examples of technical creations produced by learning about the laws of physics.

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Uloga prirodnih nauka u stvaralaštvu

SAŽETAK

Pojavni svijet je od uvijek bio i ostaje intriga za istraživanje, kako u području prirodnih tako i u području društvenih nauka. Sposobnost čovjeka da spozna zakonitosti iz pojavnog svijeta i da ih usmjeri u područje praktične primjene nauke, vodi ka tehničkom stvaralaštvu.U prirodne nauke svrstavane su, istorijski gledano, samo nauke koje su se bavile materijalnim stvarima nežive prirode. Međutim, prirodne nauke su nauke koje se bave i živom i neživom prirodom. Tradicionalna područja prirodnih nauka – fizika, hemija, biologija i geologija – još i danas obilježavaju opštu široko rasprostranjenu predodžbu o prirodnim naukama.Rad ima za cilj da doprinese uočavanju utjecaja edukacije u području prirodnih nauka na inventivnost čovjeka i stvaralaštvu u području ljudske djelatnosti.

Ključne riječi: prirodne nauke, stvaralaštvo, primjena, primjeri.