

The Scientific Essay as a Method of Teaching Physics and Astronomy in the Secondary School

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Abstract: *This article views the scientific essay in Physics and Astronomy as a method, which provokes the intellectual and creative abilities of the students for creating a short composition in a topic given. The article also points out which essay could be considered scientific, and how curiosity and creative thinking are applied for the writing of the essay. The preparation, writing of the composition and the evaluation criteria are described. There are also example topics for essays, connected with the compulsory education in Physics and Astronomy in secondary education.*

Keywords: *teaching Physics, scientific essay, curiosity, creative thinking, scientific interpretation.*

1. INTRODUCTION

In modern society, the priority in the educational policy is to ensure high - quality education. Education, concentrated on rousing interests in knowledge, is the main task of the teacher. He has to use different methods, to provoke the intellectual and creative abilities of the students so as to form cognitive interest in them. Such a method, commonly used in the pedagogical practice, is the scientific essay.

Recently, we have been witnesses of the disinterestedness of the youngsters towards natural sciences, including Physics and Astronomy. According to some authors, teachers in these subjects should apply approved educational methods to solve this problem. This will certainly regain the curiosity of the students towards nature, science and technics. Teachers' adjustment towards their role in class should also be changed. "Reality imposes more urgently to give significance to the fact that giving the maximum from yourself (including knowledge) and requiring something from others actually means to act in a forcible way. The question is: "How can we motivate learners in a favourable attitude towards learning?" [1]. The writing of a scientific essay is a creative approach which gives opportunities to answer this question.

2. CREATING A SCIENTIFIC ESSAY

An essay is a short written composition which includes personal thoughts and outlook in a particular problem. When the problem is in the field of science the essay is called scientific. It demonstrates the abilities to think in a critical and detached way, to interpret scientific facts and to argue personal point of view. In its work the student comments, confronts, seeks answers, makes inferences and conclusions. In this way the information turns into permanent knowledge.

The curious student may also make good logical reasoning in his or her composition. His thoughts are easily expressed when the he or she finds the subject interesting. It is known that one should be curious to find a topic interesting. Throughout curiosity we become well acquainted with life and the surrounding world, including nature and space. The eager - to - learn student is a motivated one, and he or she has interest in acquiring knowledge. These learners show interest towards science and their teacher knows how to promote this quality in his or her students. "The most important thing for a teacher is to know how to present the information and give examples where and when this information could be used - thus, why do they need to master it" [2].

Throughout his or her thinking, the learner applies the mastered knowledge in the scientific essay. Psychologists think that "only though thinking a person can pervade in the nature of objects, reveal the regularity in the development, and foresee the course of this development. Meanwhile, creative work is promoted through thinking, which is considered high level of knowledge" [3].

The composition is particularly appropriate when the creative abilities of the students must be evaluated. It is a well - known style in the literary set. The teacher should clarify the elements of the composition and the evaluation criteria. The writing should include introduction, main thesis and conclusion. The text should be well - structured and should show the logical attitude of the student. "The author's ability to advance arguments and express his or her thoughts should be shown. The text should be clear and accurate and should also specify the meaning of the scientific terms use" [4].

The writing of a scientific essay includes two stages. According to [4] they are:

- Preparation

In this stage, the writer analyses the thoughts and chooses the way they will be interpreted. He or she also clarifies the purpose of writing the composition and the information and ideas are arranged according to their

significance. After that a suitable structural version is chosen and the text is divided into introduction, thesis, proof and conclusion(s).

- Writing

In the second stage, the student writes the essay, seeks and argues over the connection between facts and phenomena. The writer has to compare and oppose them, to give worldly, historical and scientific examples. Famous scholars, proverbs, sayings, etc. can also be quoted. Rhetorical questions are also used.

The Physics and Astronomy teacher has the hard task to evaluate the literary skills of composing a text on a scientific topic. Not all of the Physics teachers possess the philological preparation but these teachers can easily rate the scientific essay if they have the evaluation criteria in advance. The subjective point of view is at minimum if they pay attention to all the criteria, mentioned in the list.

In the pedagogical practice the following evaluation criteria can be used:

- Thesis

The thesis is rated according to its clarity, its appropriate wording, whether or not it expresses the personal point of view of the writer as a result of his or her own cognition.

- Well - grounded text

The motive has to possess logical value, clarity of concept and subject exactness. The text should be composed on factual materials. It is desirable that the text does not include only the personal opinion of the writer.

- Putting forward other points of view

Other arguments are discussed or the writer reasons his or her own points. The main literary, scientific and technical sources are rated.

- Language and style

The linguistic culture and the style of the exposition of the student as well as the correct use of scientific terminology are studied. When a particular term has different content in literature, the writer may also use other definitions.

- Structure

The essay must consist of introduction, thesis, proof and conclusion(s).

- Content

At least 9000 characters, or in other words, 5 standard typewritten pages [4].

3. THE CHANCE TO USE THE SCIENTIFIC ESSAY IN THE COURSE IN PHYSICS AND ASTRONOMY

In the high school stage of secondary education, the Physics and Astronomy teacher may appoint essays as a way of an examination paper, homework or independent project. Table 1 includes example topics for scientific essays according to classes and chapters in the textbooks [5],[6].

Tab. 1: Example topics for scientific essays

Class	Chapter	Topic	Aims
9.	Electrostatic interaction	The meaning of the electrostatic phenomena for the human being, technics and nature	<ul style="list-style-type: none"> • To summarize the importance of electrostatic phenomena • To describe the influence of electrostatic phenomena on people and their daily routine • To make a comparison between electrostatic phenomena in nature and technics and to make conclusions
	Constant electric current	The electric current and the technical achievements of humanity	<ul style="list-style-type: none"> • To point out the importance of the electric current for technics • To describe the electrical appliances and to give reasons why they are so common • To make a connection between the technical mind, people's daily routine and the electric current
	Electromagnetic interaction	How magnets have changed people's lives?	<ul style="list-style-type: none"> • To describe the importance of magnets and electromagnets for humanity • To answer the question about their application in different appliances and equipment and how people use them in their everyday • To make parallel between electric current and magnets and to make conclusions according to their advantages
	Mechanical oscillation and waves	Are mechanical waves harmful or useful?	<ul style="list-style-type: none"> • To answer the question why mechanical waves are important to people and technics • To consider the tangible application of the mechanic

			waves <ul style="list-style-type: none"> • To compare the advantages and disadvantages of mechanic waves
	Electromagnetic oscillation and waves	The electromagnetic waves and their application in modern communication	<ul style="list-style-type: none"> • To make an analogy between mechanical and electromagnetic waves and to point out the advantages of the electromagnetic waves • To describe the significance of electromagnetic waves for telecommunications • To point out the tangible communicational applications and to give reasons why they are so important for humanity
10.	Light	Stream of particles or a wave? - In other words - light!	<ul style="list-style-type: none"> • To summarize the light events and to point out their application in optics and life • To analyze the corpuscular-electromagnetic dualism for nature and light • To formulate conclusions on the base of quantum physics
	Physics of the micro world	Physics of 21st century	<ul style="list-style-type: none"> • To point out the global meaning of Physics of the micro • To argue the application of nuclear radiation in life, technics and power • To compare the fundamental interaction and to analyze their unification
11.	Astrophysics	Me and the night sky	<ul style="list-style-type: none"> • To make a survey of the heavenly bodies and their meaning for humanity • To point out and give proof of some of the contemporary methods for astronomical observation • To analyze the possibility for new astrophysical discoveries and future space missions
		The star is like a human being - it is born. It lives and it dies	<ul style="list-style-type: none"> • To describe the essence and the global meaning of the star evolution • To compare the stages of human life and star life • To summarize the conclu-

			sions for the evolution of the Universe from the star's point of view
		Is there any future for the Universe?	<ul style="list-style-type: none"> • To point out what is the content of the Universe, when and where did it originate and why is it important for the life on Earth • To present the scientific views for the present and to argue on the hypothesis for the future of the Universe • To prognosticate for the seeking of life and intelligence in the Universe and for the discovery of new universes and civilisations

4. CONCLUSION

The writing of the scientific essay is a complicated and responsible task. However, it is easily solved, when the student is curious, motivated and if he or she can easily express his or her thoughts in writing. The ability to use the freedom offered from this genre is a good opportunity for the creative presentation of the individual thought of the student. The pedagogical practice shows that the scientific essay as a method of teaching Physics and Astronomy is an effective method for interests towards science, technics, nature and space to be arisen. Bent though the mind and viewed from another angle, they are learned and rationalized well. This also develops the motivation for mastering of new knowledge.

5. REFERENCES

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