Concerning an Approach of the Implementation of Environmental Education in the Physics Teaching System

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Abstract

This article presents a new approach of the implementation of environmental education in physics teaching system, which is particularly based on the use of integrative thematic and special physic- ecological modules. More than 30 similar integrative modules, which are included in the physics teaching course whenever required, have been formed complying with the school curriculum.

1. Introduction

At the beginning of the 21st century, the issue of the implementation of the environmental education has become more urgent and required. It is actually considered to be one of the stable bases for the further development of the civilization. Naturally, there exist various methods and approaches to the solution of this major problem in different educational systems, which particularly differ from each other in the level of their productivity. We can present the suggested approach in the following way: the sustained period of the environmental permanent education in school began with the course "The Basics of Ecology" which induces the learners to obtain environmental knowledge.

It is assumed that in secondary school, the teaching of the physics course begins with the textbooks and curriculum containing the so-called ecologized educational material. In high school, the physics is studied in a more advanced level by students with the natural sciences bias and more superficially by students having humanitarian bias. In this level of education, environmental education is integrated into the physics course, which does not decrease in any way the level of students' interest shown to the physics, on the contrary, according to the research results, it rises.

In this educational level, students of the natural sciences bias study physics by more advanced and ecologized textbooks, where integrative physics syllabus with ecological potential is highlighted and represented appropriately. The same process is carried out in the humanitarian bias of physics syllabus. For all secondary and high school groups studying physics, physico-ecological selective courses are intended, such as "Physics, Technology and Ecology", "Physics of Biosphere", "Technique and environment", etc. In this approach, the efficiency of environmental education increases, as at the end of the secondary and high school learning, when the study of the main natural sciences subjects is over, students study in different levels "Country is my home" selected natural sciences-ecological course. The mentioned approach has its own peculiarities, the performance algorithm and elements. It is clear that the mentioned issues are not possible to be discussed in appropriate depth in one article. That is why in this article it is essential, in the framework of the approach, to introduce block-modular integrative teaching problem of the

implementation of environmental education in the physics teaching system. In the teaching process, the block modular system is being applied for a relatively long time. Nowadays, when the problem of the integration of the environmental education into the teaching process along with all the other subjects and courses at schools is aroused, it means to use all the opportunities of the interdisciplinary relations of the subject and ecology and the role of the mentioned method increases.

The generalization and systematization of the physical knowledge, teaching of the skill of its substantive acquirement, the performance of various methods and forms of teaching are the main characteristics which are typical of the block-modular approach of the informative and cognitive teaching, suggested and productive in the physics teaching system.

2. Thematic and special modules

It is well-known that the module teaching is based on the following principles: modulation, structuring, mobility, flexibility and equality. In the system of physics teaching, one of the main and active components of the mechanism of our newly suggested approach is the comprehension, introduction and application of the concept of the so called thematic and main integrative physico-ecological modules.

The thematic physico-ecological integrative module appears to be, from didactic and psychological point of view, a well-grounded and acceptable combination of the main educational material, concerning the particular theme of physics, and its adjacent subject, ecology. The modular material formed on the integrated and interdisciplinary relations, after being perceived by the learners, creates a complete notion of both of the issue discussed and the deep comprehension process of the separate component subjects.

The special integrative module is physical by nature and ecological by its expression, it is a complex of close and didactic-psychological conditions meeting problems and questions, based and newly integrated into the involved special ecological theme and the concrete section of the physics course study. It is provided in the form of the generalized course or lecture to the learners of the natural sciences / physic mathematical/ or the humanitarian directions in the secondary and high schools.

The experiments have shown that during the process of working with physico-ecological thematic and teaching informative modules the cognitive style of thinking of the learners must be necessarily considered. The latter appears to be an individual, unique processing way or form of the environmental teaching information (block) provided to the learners, the inseparable elements of which are the perception, analyzing and evaluation of structuring.

The sequence or algorithm of the physico-ecological special and thematic informative teaching module construction steps could be described as follows:

Step1. Formulation of the theoretical educational content that becomes the block-module.

Step2. The formation of the algorithmic description of the necessary skills and capabilities of the block

Generally, one of the peculiarities of the block-modular education is the determination of the steps undertaken for reaching the educational goal. The goal is clear; the educational material is to be perceived totally by the learners. For the realization of the block modular education, it is essential to have a so-called technological map. It is a definite form of planning the educational material and the scheme of its module structuring is as follows:

- The exact module naming
- The suggestion of the integrative didactic goal
- The presentation of the learners' educational process curriculum
- The existence of the academic informative base

The suggested physico-ecological thematic and special educational modules, by the teacher's discretion and methodological recommendation, are attached to the components of the abovementioned plan, without breaking the structure of that plan. Thus, thematic physico-ecological modules are expected to be applied at the end of the educational material. As it has already been mentioned there is an ecologization process of educational content material of physics; accordingly , all the sections of

school (and not only) physics course and almost all the corresponding themes, which have a definite ecological potential are ecologized by reasonably integrated ecological ideas, terms, conceptions in the physics content course.

During the educational process, while applying the suggested physico-ecological modular teaching method, actually both the past material and a physico-ecological integrative teaching course in the whole educational module are given, which have a complementary, developing and generalizing property in terms of content.

Apart from this, if the suggested method contains a special informative teaching module, it turns out that basically in the teaching process of the following physics theme, the learners have an opportunity to review the following physico-ecological theme three times.

We must also mention that it is not excluded that the same learners could be related to the similar physico-ecological subject, if they are included in the selected physico-ecological courses as well.

We must also note that the name of the informative teaching module corresponds to the title of the following physics school course.

The current and final checking of the learners' knowledge, capabilities and skills is highlighted particularly by the integrative modular method of preparing the learners for the physico-ecological education.

The current and final checkings are organized both orally and by thematic and generalization test checking. The presentation of the new course is realized in different forms; lecturing, retelling, slide show and so on. If we admit that nowadays the center of the teaching process is aimed to pass almost completely to the learner, it would be regarded in the educational process as a transition of the passive perception of the knowledge to the active process of the formation of necessary skills.

In this context, the suggested informative teaching modular technologies are sufficiently productive and provide high ECE. We suggest the following series for special and thematic modules.

Table 1

N/N	Thematic physico-ecological micro-module	Special physico-ecological micro-module	
TPEM-1	Concerning the connection of physics and ecology	Ecological concepts applied in the physics course	SPEM-1
TPEM-2	The ecological element of the section "Kinematics"	The physical sources of the pollution of the environment	SPEM -2
TPEM -3	The ecological element of the section "Dynamics "	The greenhouse effect. The issues of the global warming	SPEM -3
TPEM -4	The ecological element of the section "Law of Conservation in Mechanics"	The physical basics of the ecological observation of the environment	SPEM -4
TPEM -5	Noise and vibration pollution sources of the environment	The issue of the ozone from the point of view of physics	SPEM -5
TPEM -6	The ecological element of the theme ‘’Oscillations and Waves (mechanical)’’	Scientific and technological progress and ecological issues	SPEM -6
TPEM-7	The ecological potential of the theme "Transitional Phenomena"	Energetics and ecology	SPEM -7

TPEM -8	The ecological element of the section "Basics of the Molecular Physics"	Saving of the energy, electricity, and natural recourses	SPEM -8
TPEM -9	The physico-ecological potential of the theme "Heat Engines"	The energetics and ecology of the future	SPEM -9
TPEM -10	The ecological potential of the section "Thermodynamics"	The transports and environment	SPEM -10
TPEM -11	Electromagnetic phenomena and ecology	Physics problem of ecological aspect	SPEM -11
TPEM -12	The electromagnetic environmental pollution	Physics ecologically orientated experiment	SPEM -12
TPEM -13	The ecological potential of the theme "Electromagnetic Waves Scale"	The ecological consequences of the atmospheric disastrous phenomena	SPEM -13
TPEM -14	The ecological potential of the theme "Light Waves and Geometric Optics"	The biospheric physical phenomena and ecological situation	SPhEM -14
TPEM -15	The ecological element of the section "Atomic Physics'	The optical monitoring of the environment	SPEM -15
TPEM -16	The basics of the radiation pollution of the environment	The physical basics of dosimetry	SPEM -16
TPEM-17	The scientific, (biological, physical, ecological) picture of the world	Concerning the norms of keeping the environment clean and the requirements of the existing legislation	SPEM -17
		The measures of keeping the environment clean from physical pollution	SPEM -18

And how is the content of the physico-ecological module formed? During our research, the following criteria have been developed and are operating. According to the first criteria, it is important to introduce the educational content material in such a way that its lowest edge would correspond to the lowest threshold of the content of the material presented.

For the formation of the educational module, it is a very essential criteria to structure the learner's educational activity in the logical chain of the

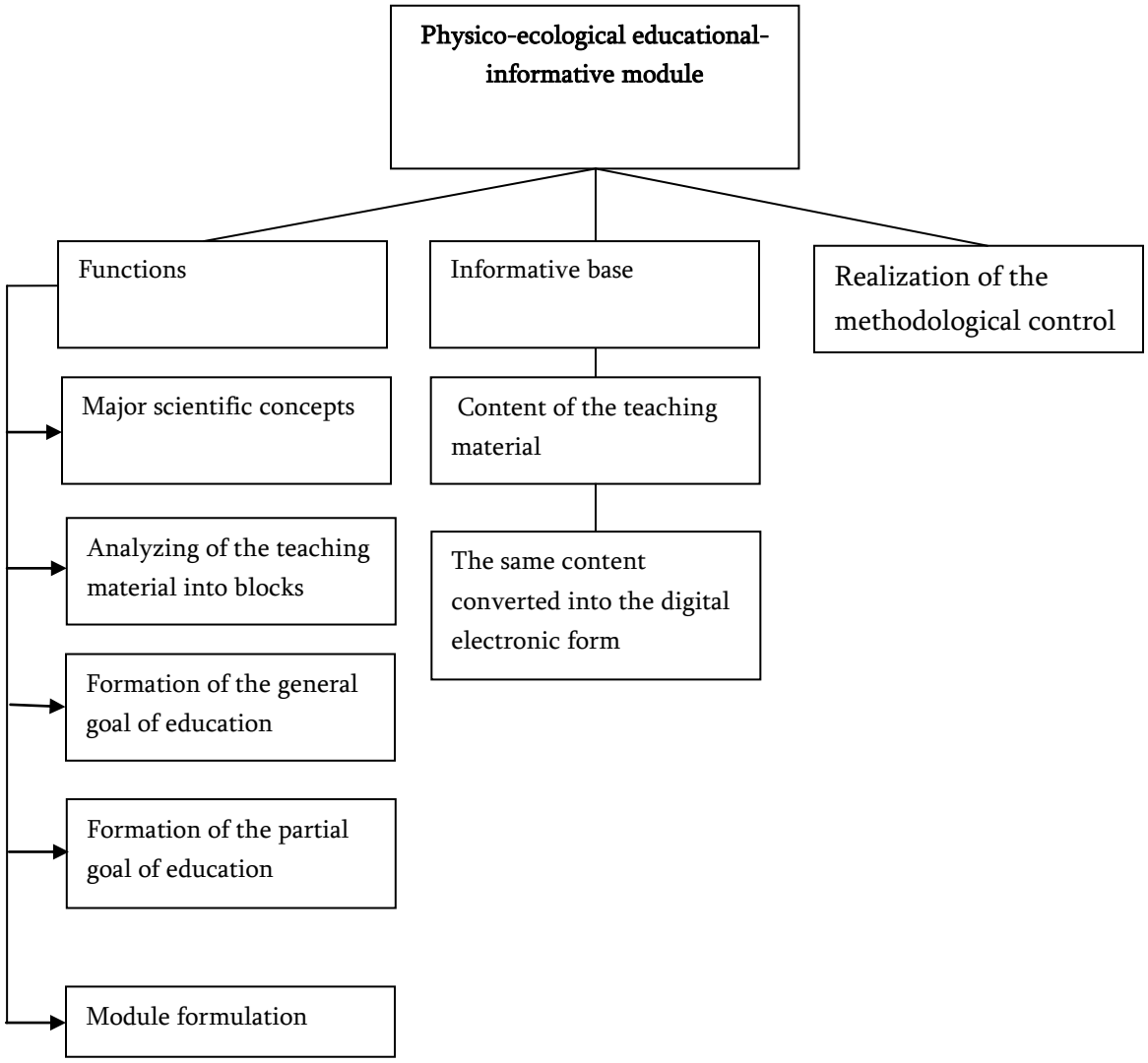
knowledge perception phases. In this case, it has a following form; to perceive $\rightarrow$ to comprehend $\rightarrow$ to think $\rightarrow$ to remember $\rightarrow$ to use $\rightarrow$ to generalize $\rightarrow$ to systemize.

Let's present the structure of the concrete informative teaching physico-ecological module. During the process of the module presentation, the following designations are used: EC-educational component, EP-educational problem, IDG-integral didactic goal, CDG-complex didactic goal, TPEM-thematic physic-ecological module, SPEM-special physic-ecological module.

During the organization of the modular education, if it simply refers to working by that technology, during the formation of the educational module, as a rule, numerous links are given both to the text-books, exercise-books and the existing educationally supported literature.

In case of a problem, the content- informative block of the presented educational module, covered issues, problems and accompanied academic information must be fully described and presented by the teacher.

Hence, the educational informative physico-ecological modules, considering structure, functions and their realization by methodological complex, could be presented by a following block-figure.



We present concrete samples of special and thematic physic-ecological modules

Special physico-ecological informative teaching module
"The physical sources of the environmental pollution"

Table 2

N/N	**Educational information and educational task**	**Management of the educational activity**
SPEM - 2	IDG: To perceive the following new concepts; "environment", "environmental pollution", "environmental physical pollution" EC 1. Environment and biosphere 2. Variants of environmental pollution 3. Noise pollution of environment 4. Thermal pollution of environment 5. Electromagnetic pollution of environment 6. Radiation pollution of environment 7. Measures for environmental pollution protection ES 1. Measuring of the noise level in the corridors of school and its surroundings. To make conclusions based on the measurement results (per a week) and to note the results on the school wall paper. 2. How to be sure about the global warming phenomenon? 3. How to measure the electrical fields created by the computer, photocopier and fridge. 4. What is a dosimeter? How does it work?	The task lasts 10-15 minutes The teacher presents in the form of a lecture. Its digital variant (if it has voice, it would be an advantage) would be desirable to provide to the learners. By the supervision of the physics teacher to carry out the measurements using the school materials if possible, otherwise to use a modern sound level meter, which can be obtained. To organize an excursion to Metsamore Nuclear Power Plant if possible.

Thematic physico-ecological module
"The Noise and Vibration Sources of the Environmental Pollution"

Table 3

N/N	**Teaching information and teaching assignment**	**The management of the teaching activity**
TPEM - 5	IDG To comprehend the following concepts and terms; "noise", "vibration", "noise level", "noise pressure", "sound pressure", "sound intensivity", "decibel"	The work lasts 10-15 minutes .

	EC 1. Environment and biosphere 2. How is noise produced? 3. What is noise? What is vibration? 4. Intensity of noise and its pressure 5. What does a noise and vibration pollution of environment mean? 6. Sound (noise) loudness level meter 7. Sound level meter, its structure and physical basics of its work ES 1. "Sound level meter, its structure, physical basics of its work" and "Measuring by sound level meter" and the realization of laboratory and practical work 2. Making measurements both in different places of school and in different places of the surroundings 3. To come to conclusions 4. To report about the results of the work to the members of the "Young ecologists" club	The physics teacher presents. By the supervision of the physics teacher In collaboration with school scientific society

Different experiments, realized by us in different educational institutions, confirm that the integration of informative teaching of special and thematic physico-ecological modules in the teaching process of physics, not only increases the interest of learners to physics, but also contributes to the solution of the urgent issues of their ecological education and upbringing.

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