ECOLOGY-ORIENTED PHYSICS COURSE IN SECONDARY SCHOOL

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A social order has taken shape in the society, which has been reflected in the Resolutions of the Government of Russia and the Administration of Krasnoyarsky Region. Among the leading elaborators of the regional comprehensive programme "Ecological Education in Krasnoyarsky Region" an important role is played by Krasnoyarsk's State Technological Academy.

A group of scientists of the Academy have developed a system of continuous ecological education to which the authors contributed a programme of a module in physics and mathematics for such secondary schools as Lyceum, Gymnasia, College etc. The "Physico-mathematical Module" consists of the following parts: the use of geoinformational systems to monitor Natural environment, the fundamentals of modelling of biological processes, some dynamic models of natural eco-systems. The programme of the module shows the importance of physics and mathematics in the study of the concordance of biological processes. An important purpose of the "Physico-mathematical Module" is to study the adjustment processes and to discover the basic constructional principles of self-regulating complex systems and to study eco-system dynamics by means of modelling. The aim of the module is to develop methods to prognosticate the effect of various influences on eco-systems and to solve the problem of rational utilization of natural resources. The content of the "Physico-mathematical Module" is based on a more profound students' knowledge in the field of physics and mathematics and so requires a better grounding not only on the part of the students, but also on the part of the teacher, a knack of working with special literature in methodology and science (both books and periodicals), thus continuously enlargeing one's scope.

Continuous ecological education presupposes an introduction not only of new ecological subjects, but also discussions of ecological problems within the general school courses. The ultimate goal of secondary school physics is to form, together with other subjects, an integral vision of the Universe. Indeed, it is into this structure of scientific vision of the Universe that ecological knowledge can be organically incorporated. The analysis of school syllabus of physics and the methods of teaching shows that the school course gives little opportunity to discuss ecological problems. The authors of this paper, however, have elaborated and intriduced a programme of ecology-oriented physics course in school № 135 in Krasnoyarsk.

The programme of ecology-oriented physics course draws the students' attention to the ecological aspects of the material currently studied at the lessons of physics, getting them to think about the ecological problems that have already arisen and the ones that are now appearing. The course aquaints the students in terms of physics with such problems as how Nature is organized, how rationally or otherwise it has been used and is being used, what processes lead to its destruction and what we could do, using the laws of physics, to protect the Natural environment and improve it both for ourselves and for the coming generations and all the living creatures. The introductory and concluding classwork in the form of lectures and seminars, envisaged in the programme, allow for generalization of ecological knowledge of disciplinary and interdisciplinary character. An important role is assigned to the eco-physical practical work when students can carry out biological testing of natural and sewage waters for pollution or test them and melted snow for pollution with heavy metals, insecticides and other substances. Besides that, students develop school projects on such issues as an eco-clean way of life at home, in school, in the district, in the town etc. The subject-matter of the ecology-oriented physics course is meant for an ordinary secondary school and does not require any additional time for its introduction in middle and senior forms. It should be noted that the authors of the programme have been using their experimental school base to prepare children for participation in competitions, olympiads, school conferences.

The authors have also developed a programme for optional courses of ecological studies for general secondary schools - "A Physicist's View on Ecology". The optional course is planned for 20 hours and is concerned with ecological issues within the main sections of school physics: mechanics, thermodynamics, the fundamentals of electrodynamics and quantum physics. A special attention is paid to experimental work carried out by the students themselves to consolidate the aquired ecological knowledge. In the course of the experiments students can determine qualitative and quantitative pollution of the Natural environment as well as propose ways and means by which it could be put to rational use. The subject-matter of the optional course is aimed at senior school students and its purpose is to generalize and systematize their knowledge in physics, astronomy and ecology.

The authors would like to draw attention to the fact that some elements of the systems of continuous ecological education are being put into practice with positive results in the courses of studies at the Preparatory Department of Krasnoyarsk's State Technological Academy, while others are still in the process of development. Unfortunately, this work is impeded by absence of Russian textbooks, insufficient information on the ecological situation in the region and lack of funds, required to equip the laboratories.