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DESIGNING A THEORETICAL MODEL OF TRAINING ENGINEERS FOR ECOLOGICALLY SAFE INDUSTRIAL ACTIVITIES

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Abstract. This paper considers a theoretical model of engineer training for ecologically safe industrial activity. The model is being formed whose main components, along with ecologically safe and socio-economic results of engineering education, include production sphere: well-tested, improved and high technologies; scientific sphere: technological innovations, basic research, discoveries, ecological aspects; training sphere: basic general engineering and specialist training, mastering one's professional activity coupled with the knowledge of safety problems and ecological compatibility of production processes.

Key words: model, ecological training, engineer.

Introduction

The level of education and vocational qualifications are among the most crucial factors in the society's social and economic development. In view of the intensive technological advances, to optimize specialist training for safe life activity that would meet the modern industrial requirements scientific research is needed to predict the package of requirements an engineer should satisfy.

As a productive force of society, an engineer performs the most important social and economic function – ensures scientific and technological progress and management of the output quality. At the same time, economic progress has a direct effect on the environment causing intensive and global pollution: chemical, physical and biological. As a participant of the production process, the engineer can change this situation. Therefore, developing of ecological standards on a continuous and integral basis within general, vocational and specialist disciplines has become a top priority in engineer training.

Aim and methodology

Our research concentrates on modeling of the prospective engineer's professional activity as a variant to the solution of the problem in question.

Methodologically and theoretically, the research is based on: social and philosophical approaches to the interaction between nature and society by V. Vernadsky, N. Agadzhanyan, E. Girousov, A. Gorelov, V. Kobylyansky, N. Moiseyev, N. Reimers; social and philosophical aspects of ecological education studied by V. Kutyrev, N. Mamedov, N. Moiseyev, A. Oleskin, A. Ursul; fundamental trends in the development of person-oriented education revealed by E. Bondarevskaya, V. Serikov, Y. Shiyanov, I. Yakimanskaya; modern concepts of ecological education put forward by S. Glazachev, I. Zverev, D. Kavtaradze, G. Sikorskaya.

The following methods of research have been used: analysis of philosophical, psychological and educational literature on the problem under investigation; analysis of ecological education practised in the world and in the country; research and generalization of educational experience; modeling; retrospective analysis of the authors' own experience.

Results

Modern technological progress is understood as a set of technological systems aimed at securing ecological compatibility and security of industrial projects. Therefore, it is essential to introduce the knowledge obtained into the production process so as to achieve its high ecological performance. This is the key part of training prospective engineers where the depth of knowledge forming a desire for creativity, an ability to design qualitatively new models and update the old ones, is of exceptional importance.

Modeling of specialist training, which is underway now, is based on high science and computer technology as well as an ability to run production systems. What deserves special consideration is an ability to single out the most important things in the basic disciplines to address the problems of ecological compatibility and industrial safety, a possibility to give an account of laws and methods by

means of which basic technological discoveries can be used in combination with the quality of technosphere. Building a model of training a prospective specialist is possible on condition that there is a clear view of the initial and final result.

In their days, S. Pegov, D. Gvishiany, Yu. Rastopshin, E. Girousov and others pointed to both - a possibility and a necessity of using modeling while investigating socio-ecological problems. In so doing, the authors emphasize a fundamental principle of modeling to be taken into account which is based on structure functional correspondence between the model and the object. However, there exist a lot of models that can fit with the actual object, therefore the choice of the necessary model is determined by the functions and properties that the researcher is interested in.

The terms 'model' and 'modeling' presuppose applying criteria of quality of training that a specialist should meet, establishing correlations between them and the educational conditions aimed at their formation. At the same time, not all authors attach the same meaning to the term "specialist model". The definition which should be considered as the most acceptable is the one given by E. Smirnova who treats the specialist model as the analogue of his activity expressed in representative characteristics identified as a result of studying operating and living conditions of the body of specialists that we take interest in [3].

Thus, the model describes not a profession or trade but someone who does the job. Besides, the design model should satisfy social needs in the light of market transformations. A prospective engineer as a knowledge - and professional skills carrying medium will be able to compete for a place in the labour market. Therefore, in our opinion, the model structure should include the following components: the objects of acquisition in the process of training, requirements for personal qualities of a prospective specialist, requirements for skills, habits and methods of activity of the specialist.

The practical application of modeling as an instrument of studying certain objects or phenomena is based on building a model of training of the future engineer of personal and social safety which presupposes singling out all its constituent elements, identifying their significance for ecologically safe production process and establishing correlations between them.

Modeling of the operational and practical component of the engineer's future activity includes the following:

- identifying standard professional challenges that a specialist is to meet in order to secure standards of performance in the light of negative industrial effect on the environment and humans;
- on their basis working out field tasks fully covering all ecologically safe production activities;
- determining positions of these tasks in the content of training (in the syllabi of the disciplines taught);
- choosing optimum forms and methods of instruction while examining each task [1].

One should take into account the fact that the future specialist masters a type of activity which is new to him, moving from simple elements to more complicated ones and finally becomes proficient in full-fledged professional and ecologically safe activity. Therefore, model designing should be started in the opposite direction: from activity in general to its components and further on to its elements keeping up the connection between them. This is where the didactic principles of the model such as systematic character, consistency and accessibility in general manifest themselves.

The requirements that should be met while designing a model of specialist training for ecologically safe activity include the following:

- completeness of the model, that is the content of the future professional activity should correspond to the standard of professional challenges to be met;
- connection with theoretical study which makes it possible to use the information to solve ecological problems; the time of material studying determines the place for making certain decisions.
- generalization of tasks which will allow to cover the most important aspects of professional activity and the most meaningful parameters;
- typification of tasks and consideration of a possibility to transfer skills from one scope of activity to another;

- consideration of typical obstacles and mistakes that a specialist faces or makes in his professional activity which makes it possible to get the specialist ready to overcome obstacles and deal with problems that might arise;
- choice of appropriate forms, methods and techniques of teaching to meet challenges of theoretical and practical character which will activate the specialist's cognitive activity during training.

After the requirements have been determined, the model is being formed whose main components, along with ecologically safe and socio-economic results of engineering education, include:

- production sphere: well-tested, improved and high technologies;
- scientific sphere: technological innovations, basic research, discoveries, ecological aspects;
- training sphere: basic general engineering and specialist training, mastering one's professional activity coupled with the knowledge of safety problems and ecological compatibility of production processes.

Designing this specialist model for safe life activity requires detailed elaboration on the requirements that an engineer should meet in order to provide a harmonious development and existence of the system "man – environment"; the requirements that would form professionally meaningful parameters of the specialist necessary for successful execution of production tasks and social duties [2].

Conclusions

1. The ecological approach to vocational training of prospective engineers is not only a requirement of new developmental concepts, either global, regional or national. It also provides for a professional flexibility of future specialists. The ecological knowledge obtained by students from general, vocational and specialist disciplines should be synthesized and centered around professionally meaningful knowledge and skills that are required for future professional activity of the specialist in training.
2. It should be remembered that modeling of an engineer not only provides an ample opportunity to identify and predict requirements that an engineer should meet. It is also an important component of specialist general training for future ecologically safe production activity and methodological basis for planning training and education.
3. Practical applications of the ecological approach to training have proved the fact that being guided by the aforementioned requirements that an engineer should meet is a motivating factor in improving the system "student – university – society"; it produces qualitative results in engineer training with environmental views on production and production relations.

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