

INFORMATION AND COMMUNICATION TECHNOLOGIES IN THE PROCESS OF MINING ENGINEER TRAINING

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Abstract: *Based on scientific analysis the authors of the article argued the necessity of solving priority tasks – the development of new educational technologies aimed at supporting the training of engineers in terms of the mining engineering as high-tech industry. The features of mining computer technologies are determined.*

There was worked out the project of the adaptive system of a mining engineer individual training "Electronic manual" aimed at the development of future professionals. The essence of individual preparation of future mining engineer ICT is defined.

It is proved that the efficiency of the designing and planning of mining operations through the introduction of ICT at present is the real way to influence the quality of mining products that will promote individual learning orientation. For the first time pedagogical foundations for introducing adaptive training of mining engineers are clarified.

Keywords: *mining industry, information and communication technology, the process of a mining engineer training, computer-oriented training, adaptive system of mining engineer's training.*

INTRODUCTION

Under the laws of Ukraine "On Higher Education", "On the National Informatization Program", "On the basic principles of development of the Information Society in Ukraine for the years 2007-2015" "National Strategy for the development of Education in Ukraine (2012-2021)", the strategic objectives of modern education are to create conditions for the use of information and communication technologies (ICT) in teaching and learning students, which facilitates effective resolution of complex problems of specialists' training in general and mining engineers in particular.

The national program of informatization [2] defines the strategy of solving the problem of providing information needs and information support in the areas of national importance, including education.

According to Russian and Ukrainian researchers (V. Bykov, M. Zholdak, N. Morse, S. Rakov, J. Ramsky, O. Spirin, J. Trius), the benefits of using ICT are as follows: the individualization of learning, intensification of individual work, increase of executed tasks, information flow expansion while using the Internet, rise of motivation and cognitive activity.

MATERIALS AND METHODS

In our view, the experience of foreign colleagues [1, 4, 5, 7] is valuable when in engineer training a radical shift from the "school of Memory" to the university is carried out, where a student is taught to work with his / her own thinking. The transformation of the educational system to the scope of cognitive assimilation methods and engineering, communication and engineering culture radically changes the perception of the higher educational establishment with its educational process.

An important area in the development of engineering education in this sense is a special organization of work in complex multidisciplinary practice-oriented groups, organic students' engaging in creative activity, their mass participation ensuring in scientific- and teaching research work.

The main task supposed to be solved by the modification of educational system is to provide students with fundamental knowledge, form the competencies, which enable further opportunity to apply ICT first in teaching, and professional activity in the future.

Therefore, regard to the provisions of educational and vocational training programs and educational qualification characteristics of specialists in specialty 6.050301 "Mining", specifics of their professional activities, also on the basis of analysis and synthesis of scientific research, the implementation of educational objectives is possible in terms of adhering to the demands of a mining engineer training, which should be based on the following principles: analysis of traditions and innovations in scientific, technical and socio-economic sphere; prediction of the semantic and structural changes of mining industry, science and also educational needs of the population; research of the processes of the country economic formation and the directions of regional economies development; systemic definition of the purpose and activities of a mining engineer; studying of the state and market dynamics of engineering labor market; consideration of the role of personal organization of a qualified professional in engineering thinking formation, self-development and professional creativity.

In this regard educational process of mining engineers' training needs considering and revision; there is a task of a new educational technology development aimed at training engineers in terms of mining industry as high-tech manufacturing. Introduction of advanced technologies in mining engineers' training is considered by the scientists (J. Vilkul, V. Kalinichenko, A. Kupin, V. Morkun, M. Stupnik) who suggest to review the technology and implementation of the educational process of a mining engineer training. To their mind, educational and scientific process should be presented as a system of creative workshops that will create the appropriate academic school where the continuity in the methodology of cognitive activity, values and purpose of engineering work is implemented.

Existing methods of mining operations' designing and planning do not always meet modern conditions of management. One of the reasons for such state is a crisis of theory and methods of mining optimization. In contrast to the regulated economy, demand for ore production in the current conditions is not fixed as it fluctuates due to market conditions.

The low level of informatization on mining complex doesn't allow taking into account the factors that lead to the replacement of exact calculations by approximate ones, absence of multi variant analysis, errors and uncontrolled losses in production. In addition, both regulatory and emergency operating conditions should be taken into account. As a result calculation and selection of effective operating modes in mines acquire great significance.

The solution of this task without the use of ICT is almost impossible. The efficiency of mining, especially in enterprises depends on the completeness of the analysis of geological data on mineral deposits. The basis of these calculations consists of the information about the array of overburden rocks, spatial location and distribution of minerals within the open pit area, hydro-geological conditions of ore occurrence, possibilities of production and transportation to mining and processing enterprises.

As the experience shows only a complete line analysis of geological data with modern ICTs usage allows achieving maximum of economic efficiency of mining production at minimal loss of minerals.

The rise of the mining enterprises' efficiency in a market economy, increase of manufacturing and financial activities requires developing, mastering and application of modern information technologies that allow introducing mining and geological information based on the field of geological models and digital relief plans, also automate the calculation of reserves and scheduling of mining operations. Accordingly, the informatization process of future mining engineer training is an urgent task nowadays.

Equally important is the fact that mining is a complex integrated process that combines not only the development of natural and man-made resources, fixed assets and production staff providing production, primary processing of raw materials, but also other mineral resources linked with them: energetic, airy, water ones etc. The development of mining production, growth of using mineral resources require constant development of scientific substantiation of new technologies, creation of new machines and devices, research of safe methods of carrying out mining operations.

According to this there is a change of approaches for professional characteristics of mining industry workers' assessment. Therefore formed before (and sometimes educational models outdated) and intended to transfer the knowledge and skills that provide constant promotion track and employment throughout the period of labor activities on one or more working places, they are no longer able to provide professional training required by modern economy. It is worth emphasizing that in the process of mining companies' access to foreign markets, the quality of products doesn't meet international standards: incomes, obtained for it are significantly lower than those generated from similar Western companies. In such circumstances, the only solution for the majority of organizations of mining and geological profile is to increase efficiency, in other words to reduce production costs by simultaneous improvement of the products' quality. One of the most powerful tools for this is computerization, which can significantly increase the speed and completeness of all information (geological, economic and environmental), which is within the enterprise, also provide a new level of adoption of optimal and flexible management, project and planning decisions.

In addition, it is necessary to distinguish the features of the computer technology mining: full use of geological information in resolution of a number of tasks, the most accurate account of mineral raw materials movement, opportunity of multi variant mining calculations and the acceptance of optimal strategic decisions that provide great economic benefit, organization of the automated system of monitoring and quality control of ore, automation of any graphic material creation. In this context much attention should be given to the fact that among the mining tasks the most appropriate for automation are: optimization of finite paths and career development schedule for the selected search criteria, detailed three-dimensional design of the development of outdoor and underground mining with semi-automatic construction of open-cast mine roads and evaluation of deposits falling in outline testing, multi variant three-dimensional planning of mining operations at any period of time; design of drilling and blasting operations in quarries and mines; drawing up schedules of ore extraction for a period from shift to the whole period of working a deposit; geo-mechanical, ventilation, engineering and construction calculations; making all kinds of drawings that accompany the mentioned above calculations. It should be taken into account that many of the afore-mentioned works are carried out by specialized project, geological and scientific research organizations. On condition of ICT implementation in industry, its necessity decreases and the company can perform most calculations by itself involving free-lance specialists and experts from other consulting companies only for resolution of the most difficult problems, highly-focused knowledge, requiring a high level of training.

RESULTS

In Kryvyi Rih National University the project for solution of mentioned problems was developed. This project presupposed theoretical ground and practical implementation of adaptive system of individual training of mining engineer – "Electronic manual". It favors professional formation beginning with the vocational guidance in educational establishments of different accreditation standards and courses of advanced training at the leading enterprises. The target of the offered project is formation of individual approach to the realization of program for the training of mining engineer in every stage of its formation, beginning with the choice of specialty and finishing with the end of the professional career. Tasks mentioned in the project:

1st group of tasks: 1) to group theoretically the conceptual positions of the computer-oriented system of the training of mining engineers; 2) to develop the model of mobile environment for the training of mining engineers "Electronic manual". *2nd group of tasks:* 1) to develop the components of system for computer-oriented education of higher mathematics, physics and chemistry; 2) to develop the methodology of using the system of computer modeling while studying fundamental disciplines. *3rd group of tasks:* 1) to prepare the complex of teaching aids "The library of mining engineer"; 2) to work out the project of new educational qualifying characteristics of the mining engineer. *4th group of tasks:* 1) to make the mobile environment for training of mining engineers "Electronic manual"; 2) to check the efficiency of updated system of training of mining engineers.

The project assumes three stages:

I stage: Theoretical and methodological principles of the research; *Content of the stage:* working out the concept according to which information and communication technologies in educational process is the subject of studying and the means of teaching that enable the development of professional competence of mining engineer; substantiation of the modern approaches; realization of principles; usage of methods.

II stage: Designing of a system of continuing training of mining engineers; *Content of the stage:* preparing and publishing of "The library of mining engineer", updating of educational qualifying characteristic of mining engineer; improvement of the methodology of teaching of fundamental and profile disciplines.

III stage: Realization of approaches and principles, implementation of the methods, usage of information and communication technologies in the process of training mining engineers. *Content of the stage:* working out and implementation of the mobile environment in the process of training mining engineers, "Electronic manual".

The system of training of mining engineers is theoretically grounded, designed and checked. It corresponds to European model of educational mobility.

Offered system contains the complex of diagnostics, trainers, manuals, textbooks, study guides to the laboratory and practical works, course assignments and graduation thesis, program modules. It considerably improves the level of professional competence of mining engineers in the process of continuing mobile access to the educational methodological materials. The structure of system assumes three main units: database, solver and intellectual interface, which enables the intercourse with "Electronic manual". It makes the system adaptive and mining engineer – highly qualified and mobile.

Computer-oriented training offered in the project is based on the fundamental and applied scientific researches in the sphere of new computer means and information technologies of mining engineering. It occurs in the following areas: computer systems of identifying of language and eye images; creating of computer system interfaces of new generation; computer systems and electronic means, new robotic systems with high-level intellectualization of guidance. Subject to the type of tasks the following systems are used: prognostic, diagnostic, planning, interpretation and systems of monitoring and administrating. However, experience shows that cognitive interest can be improved at the expense of usage of mobile educational environment. It gives an opportunity not only to reproduce learned information but to use creatively in the trainers and laboratory virtual complexes of "Electronic manual". Current problem is hardly mentioned in the researches devoted to the training of mining engineers.

The participants of the project developed patents "Way of supporting of resolving in mining engineering" № 68697U Bul. № 7/10.04.2012, "System of automatic direction of enrichment process" № 66425A Bul. № 2/21.02.2011, № 66425 Bul. № 1/10.01.2012, the thesis was defended: "Scientific bases of formation of steady state of violated phase-heterogeneous massif in the process of subsurface exploitation of slope ore deposit" (M. Stupnik).

Information-calculating complexes and adaptive systems of guiding of technological process of minerals concentration were developed and on its ground. They were implemented at the mining enterprises, in scientific-industrial and planning organizations of Ukraine, Russia and

DPRK (V. Morkun). Mining orientation of Dnipropetrovs'k region favors the creation of new methodological systems of training which are based upon information and communication technologies, virtual laboratories. It helps to bring the educational process nearer to the real conditions of work. Educational tasks, which were developed on the ground of "Electronic manual", are done via initiation and increase of activity. It happens because the examined situations occur in the real environment of mining engineers in every stage of professional formation.

The novelty of the offered project: In this project for the first time we defined pedagogical principles for implementation of adaptive system of training of mining engineers beginning with vocational guidance and ending with courses of advanced training on the basis of integrated structure of artificial intelligence "Electronic manual".

Scientific production is confirmed with the interest of Ukrainian and foreign specialists in different fields of education and science. Developed project is the theoretical-methodological ground, on which the further studying of theoretical, historical-genetic and prospective-prognostic directions can occur.

CONCLUSIONS

The analysis of scientific researches devoted to ICT in the individual training of mining engineers and considered practical experience indicate the complexity, multiple-aspect and insufficient design of mentioned problem. The individual training of the future mining engineer by means of ICT can be defined as integrated characteristics of his personality, which contains the complex of scientific, professional knowledge, abilities, skills and personal values.

Following these aspects mining engineer is able to attend to social and professional duties. Further researches assume the choice, scientific-technical substantiation and implementation of efficient ICT and pedagogical technologies in the educational process in order to form individual approach to the realization of program of training of mining engineers in all stages his formation, beginning with the choice of specialty and finishing with the end of his professional career.

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