Mining engineers training in context of innovative system of Ukraine

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Abstract
The paper clarifies the process of a mining engineer training in terms of the innovation system of Ukraine. The authors analyze a number of normative documents concerning innovative activity in Ukraine in general and mining business in particular. In the process of implementation of innovations into mining industrial complex urgent problems are defined. The methodology of information and communication technologies (electronic, distance and mobile studies) usage in engineers training within the conditions of university education is offered. It is marked that the worked out methodology finds its practical introduction: e-learning involves creation of the portal "Electronic mentor"; distance learning is presented in the study of professional disciplines as an example of the course "Computer Technologies in Mining"; mobile learning is considered as an example of discipline "Computer Science and Engineering."
Keywords: TRAINING OF ENGINEERS, INNOVATION SYSTEM, METHODOLOGY ENGINEERS TRAINING, ICT TECHNOLOGIES.

Legal framework for strategic ways of scientific and technological development of Ukraine is presented by a row of laws: “About innovative activity", "About the government special purpose programs”, “About priority areas of science and technology development”, “About special schedule of innovation activity of technology parks”, etc. Among them, an important place is occupied by the Law "About priority directions of innovative activity in Ukraine", in which an action plan as for conceptual position of public policy reforming in innovation area is adopted [1; 2; 3; 4; 5].

As well-known foreign (I. Shumpeter, G. Mensh, B. Santo, A. Kliainknecht, Ya. Van Dane, B. Tviss) and Ukrainian (B. Andreev, Yu. Astafiev, V. Byzov, Ye. Yevtechov, Yu. Kaplenko, G. Malachov, M. Stupnik) scientists note, it is the innovations that are the source of a significant increase in the efficiency of production in general and mining one in particular.

Despite the growing interest concerning the development of the national innovation system in mining industry, now in Ukraine there hasn’t been formed an innovative public policy, which could take into account the accumulated international experience of forming innovative structure and would be adapted to the national reality. Accordingly, during the introduction of innovations in a mining industrial complex, scientists [6; 7] advise to take into consideration the following factors:

1. exhaustion of rich deposits with simple mining and geological conditions in accessible mining and socio-economic mastered regions;
2. a limit of growth of the productivity whilst the implementation of innovative technologies;
3. depreciation of capital assets (the question is not only about physical wear and tear but also about moral aging of mining machinery and equipment in particular;
4. low ecological compatibility of row of objects, on the foregoing factors of general funds’ wear and tear in particular.

It is important to admit that in the process of mining enterprises going out to foreign market the quality of products does not meet international standards, the profits, got for it are much less than those, that analogical western companies posses. In such circumstances the only solution for nearly every organization of mining and geological profile is increasing of production efficiency, which means reduction of its production costs by simultaneous improving of the quality of products output. One of the most powerful tools for this is computerization, which can significantly increase the operational efficiency and completeness of the use of all information (geological, economical, ecological) presented on the enterprise, also provide a new level of making optimal and flexible, administrative, project and scheduled decisions. Each enterprise has a wide range of tasks related to enormous information content processing, multiple reiteration of monotonous calculations that require the leading out of plenty of graphic materials.

All the problems mentioned should be taken into account in the process of modern training of a mining engineer, who in his future professional activity will be able to incorporate innovative technologies into mining industry. According to this, attention is being drawn to innovative systems not only in technological, but also pedagogical discourse.

It is hard to imagine modern specialist training without extensive introduction of computer technologies into educational process of institutes of higher education, which allow to find the information, needed for educational aim in a moment. The level of novelty of the obtained information, if properly searched, will be maximum, as internet data update takes place daily, in some cases even hourly.

To sum up, it is important to highlight the benefits of mining computer technologies: complete use of geological information in solving a number of tasks, maximally exact account of flow of mineral raw materials stocks; possibility of multiple calculations of mining works development and receipting of optimal strategic decisions, which give large economic effect; organization of the automated system of ore quality control and management; automation of any graphic materials creation.

Modern study facilities should be attracted to educational process not episodically, isolated one from another, but in a certain system. Such form of study facilities organization can be presented in a form of learning programs, which, on the one hand, serve as a basis of learning programs creation, on the other hand – as a ground for topic or section illustrating.

Taking into account the aforesaid, in the mining engineer training it is expedient to use *electronic studies* which scientists define as a process of knowledge transmission and guidance of learning process by means of information and communication technologies. The main

preconditions and reasons for the use of e-learning studies are as follows: influence of information society, globality as a personal feature of information society, rapid development of information and communication technologies, increase of the knowledge, accumulated by humanity and impossibility of its effective mastering by means of traditional methods and approaches, obsoleteness of a traditional system of staff training for solving the tasks of modern times. As an example of e-learning in continuous training of future mining engineer may be the creation of an Internet portal "Electronic mentor."

In Kryvyi Rih national university there has been worked out the project that will assist the professional becoming of mining engineers, from career guidance in educational establishments of different levels of accreditation, getting education in establishments of higher education to qualification enhancement courses on leading enterprises. Moreover, it will provide individual learning curve.

Priority conditions for mining engineers in the project are as follows: continuous process of professional development (school – higher education establishment – enterprise); increase of volume and deepening of fundamental knowledge of natural processes and their scientific substantiation; readiness for completing complex scientific and research, project design work; readiness for supporting safe functioning of complex technical systems.

Creation of the system is a good base for individual learning, person's self-perfection (Fig.1).

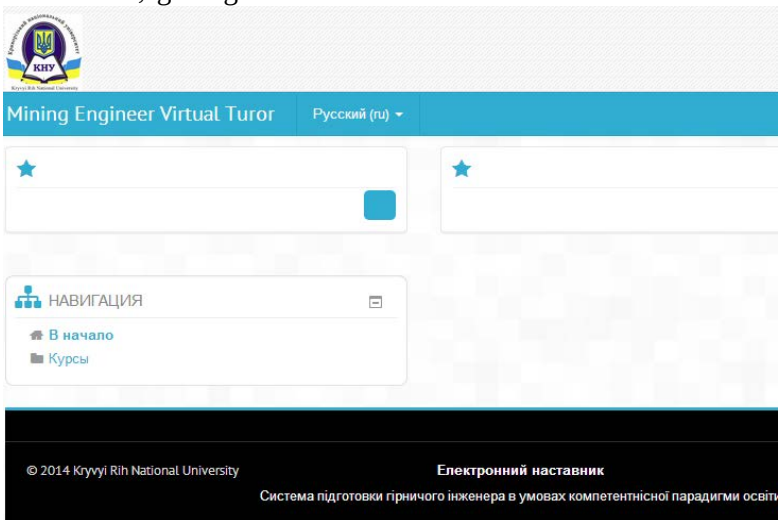


Figure 1 Homepage of educational web portal "Electronic mentor"

The important section of the portal is a unique library of "Mining engineer" consisting of 14 textbooks which fully cover the vocational training course of specialty "Minerals deposit development". These books can also be used by the young specialists to improve professional skills and by students of specialties relating to mining engineering (geological, geodesic, ecological).

Electronic portal positively favours the increasing of knowledge, comprehending and receiving professional skills, solving mining problems in Ukraine including Prydniprovsk industrial region. This portal helps students to use these skills in their professional activity. The system includes the structure of continuous education which gives students and mining engineering specialists an opportunity to discuss the subject matter of their work and researches on the forums of "Electronic mentor".

Educational tasks worked out on basis of "Electronic mentor" are settled due to initiation and increasing activity inasmuch as the examined situations occur among mining engineers at each stage of professional formation.

The following component of educational ICT is *distant education* (technology based on principles of accessible education, offers computer educational programs for different purposes and modern telecommunications for delivering educational information and off- and on-line communication).

We suggest a discipline "Computer technologies in mining engineering" as an example of distant education adoption in the process of mining engineers training. This discipline is a part of optional educational schedule of vocational training of specialty "Mining engineering".

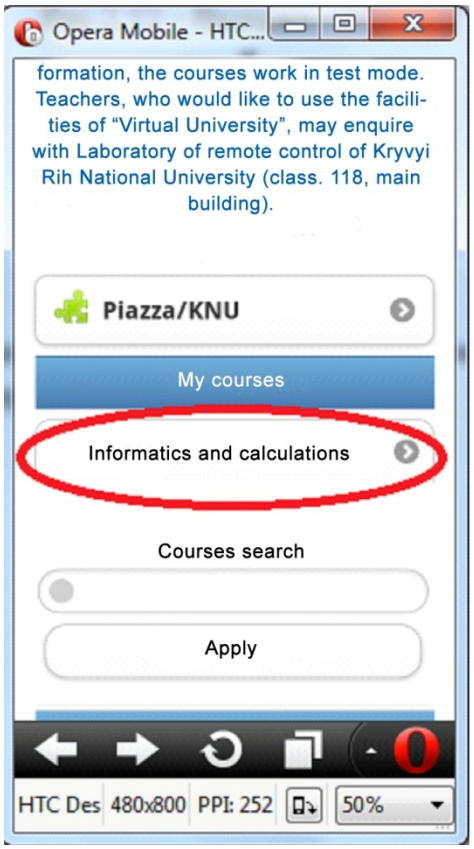
Structure of course credit with a final test:

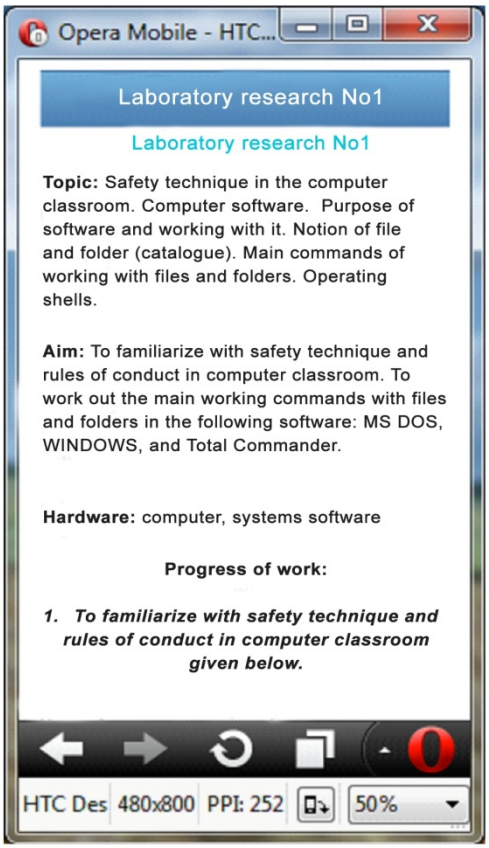
Final module 1 Usage of the computer mathematics systems in the engineer researches: T.1 Theoretical and practical bases of mobile ICT usage in educational process. T.2 Study of computer mathematics system Wolfram Alpha. T.3 Solution of the professional area tasks in the mathematics packet PTC Mathcad.

Final module 2 Solution of specialized professional tasks using professional packets of applications: T.4 General information about computer designing and products solid modeling. Study of editing program bCad, Compas. T.5 Automatic designing of electronics and integrated modeling schemes of analogue and composite analogue and digital schemes in the programs Orcad, P Cad. T.6 Automatic designing in the industrial packet AutoCAD. T.7 Scheme supplying and designing of analogue, digital and analogue and digital circuit in Electronics Workbench. T.8 Bases of architecture projection using SketchUp, Google Earth.

Mobile education is considered as a type of distant one. Peculiarity of such education is an opportunity given to students to choose hardware-based ICT for studying (mobile phones, pocket PC (PPC), smartphones, e-books, players for recording and listening to lectures, personal digital assistant, pads, netbooks). Furthermore, organization of educational process can occur at any time, anywhere owing to the usage of mobile devices (tablet computers, mobile phones, etc.). Nowadays tendencies of ICT development is that all kinds of educational activity will be supplied with mobile devices.

The example of such education is adoption of mobile course “Informatics and computer engineering” (Fig. 2) during teaching informatics disciplines in the process of mining engineers training. In this course owing to mobile devices a lecturer has an opportunity to monitor the educational information, control students educational activity including the level of execution of individual tasks for laboratory works, passing thematic tests etc. A Student can review the educational information including video-lectures, look through course news, receive methodological instructions from the lecturers, communicate with group-mates etc.





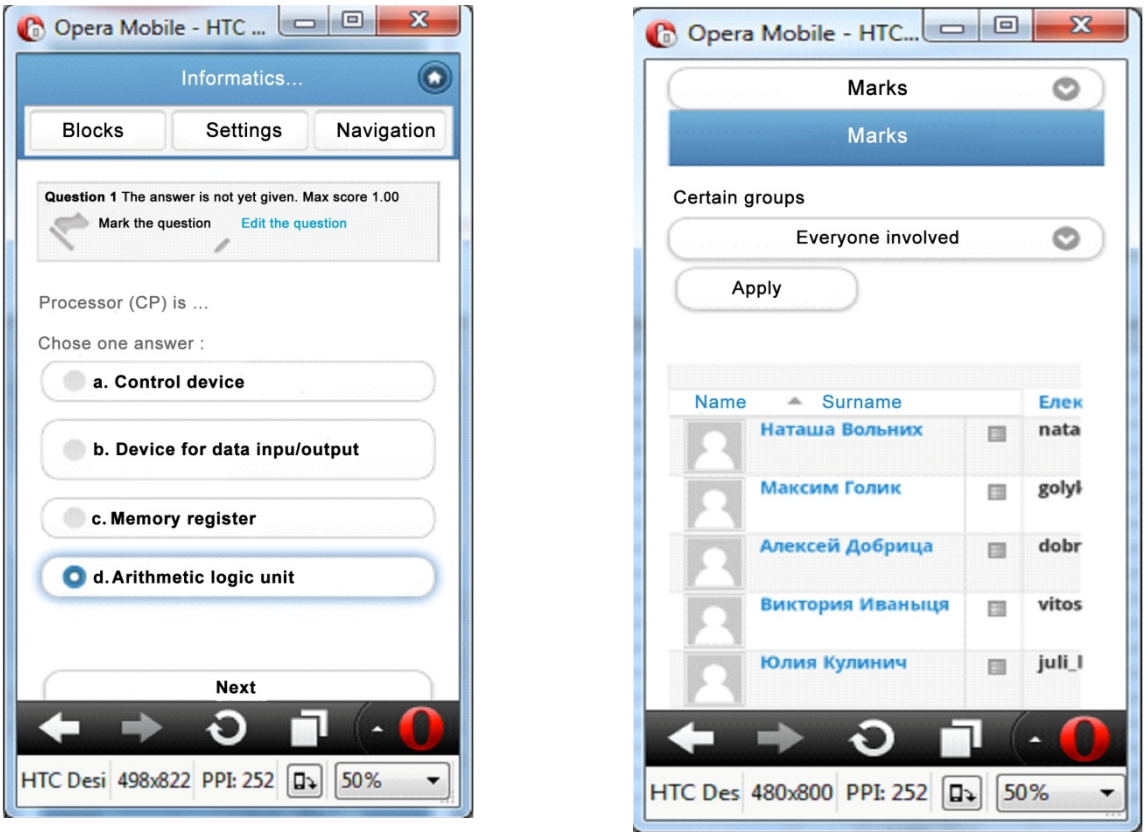


Figure 2 Home page and window of reviewing laboratories, mark register of the group (mobile device view)

Mining engineers should use not only computing machinery but also new information systems and advanced manufacturing sciences. For increase of quality of professional training, the following kinds of educational activity must be practiced: problem lectures; discussion lectures; laboratory and practical work of research area; solution of situation tasks; business games; composite and term and diploma projects of actual subject matter; students written tests with a help of ICT.

Thus innovation technologies include the formation of the educational process where the main important task is to keep up interrelated activity of lecturers and students. The principal purpose of such activity is the solution of educational and practical tasks using such modern ICT as electronic, distant and mobile technologies. Following researches include the choice, scientific and technical substantiation report and adoption of effective ICT and pedagogical technologies in the educational process to form individual approach to realization of the program of mining engineer training at all stages of professional formation, from the choice of profession to the end of professional career.

References

1. “Zakon Ukrainy “Pro derzhavni ciliovi prohramy”. 2004. Uriadoviy kurjer 25: 352.
2. “Zakon Ukrainy. Pro specialniy rezhym investyciinoi ta innovaciinoi diialnosti tekhnologichnykh parkiv”. 2002. Vidomosti Verkhovnoi Rady Ukrainy (VVR) 33: 238.
3. Morkun V. S., Porkuyan O. V. 2009. “Optimization of management of iron-ore production quality on the basis of ultrasonic control.” Paper presented at the IV international conference “Strategy of the quality in industry and education”, Varna, Technical national university 143 – 147.
4. “Pro innovaciinu diialnist. Zakon Ukrainy”. 2002. Vidomosti Verkhovnoi Rady Ukrainy 36: 266.
5. “Pro priorytetni napriamy innovaciinoi diialnosti v Ukraini. Zakon Ukrainy”.

2003. Vidomosti Verkhovnoi Rady Ukrainy 3: 93.
6. “Pro priorytetni napriamy rozvytku nauky i tekhniky. Zakon Ukrainy”. 2001. Vidomosti Verkhovnoi Rady Ukrainy 48: 253.
7. Stupnik N. I., V. A. Kalinichenko, M. B. Fedko, Ye. G. Mirchenko. 2013. “Influence of rock massif stress-strain state on uranium ore breaking technology.” Scientific Bulletin of National Mining University 2: 11.