

USE OF INFORMED EDUCATIONAL ENVIRONMENT IN THE PROFESSIONAL ACTIVITIES OF FUTURE ENGINEERS

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Annotation: The article develops a special methodological system for the development of such qualities as engineering thinking, independent work skills, technological literacy and professional adaptability through the information and educational environment in the higher education system. The article was prepared based on the experience of specialists involved in the implementation of scientific and theoretical developments into practice.

Keywords: Engineering games, information and educational environment (IEE), engineering teachers, software and didactic tools, Expert assessment, Comparative engineering, Reengineering, Cost engineering, Engineer in a technical system.

BO‘LAJAK MUHANDISLARNI KASBIY FAOLIYATIDA AXBOROTLASHTIRILGAN TA’LIM MUHITIDAN FOYDALANISH

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Annatatsiya: Maqolada Oliy ta’lim tizimida [axborot ta’lim muhiti](#) orqali [muhandislik tafakkuri](#), [mustaqil ishlash ko‘nikmalari](#), [texnologik savodxonlik](#) va [kasbiy moslashuvchanlik kabi xislatlarni shakllantirish uchun maxsus metodik tizim ishlab chiqilgan](#). Maqola ilmiy-nazariy ishlanmalarni amaliyotga joriy etish ishlari bilan shug'ullanuvchilarga asoslab tayyorlangan.

Kalit so'zlar: Muhandislik o‘yinlari, axborotlashtirilgan ta'lim muhiti (ATM), muxandis-pedagoglar, dasturiy-didaktik ta'minot, Ekspert baholash, Qiyoslash muhandisligi, Qayta muhandislik, Tannarh muhandisligi, Texnik tizimda muhandis.

ИСПОЛЬЗОВАНИЕ ИНФОРМИРОВАННОЙ ОБРАЗОВАТЕЛЬНОЙ СРЕДЫ В ПРОФЕССИОНАЛЬНОЙ ДЕЯТЕЛЬНОСТИ БУДУЩИХ ИНЖЕНЕРОВ

Аннотация: В статье разрабатывается специальная методическая система формирования таких качеств, как инженерное мышление, навыки самостоятельной работы, технологическая грамотность и профессиональная адаптивность посредством информационно-образовательной среды в системе высшего образования. Статья подготовлена на основе опыта специалистов, занимающихся внедрением научно-теоретических разработок в практику.

Ключевые слова: Инженерные игры, информационно-образовательная среда (ИОС), инженеры-педагоги, программное обеспечение и дидактические средства, Экспертная оценка, Сравнительный инжиниринг, Реинжиниринг, Стоимостный инжиниринг, Инженер в технической системе.

Studying professional development of future engineers as a pedagogical problem requires in-depth analysis of theoretical, methodological and practical aspects of this problem. In the training of future engineers, it is necessary to develop such professional qualities as development of professional skills, non-standard thinking ability, quick and clear decision-making, critical thinking of problems, ability to manage behavior and own activities, skills of working with various resources and competitiveness. In addition, the requirements of employers demand that graduates have not only "knowledge", "skills", "ability", "preparation", "qualifications", but also professional competences in terms of activities. The role of engineering competencies in increasing the competitiveness of future engineers is of particular importance.

In order to understand the essence of the concept of "Information learning environment" in the training of engineers, we consider it necessary to review the theoretical studies that present the concepts of "Learning environment", as they are the base phrase for the research being promoted.

The information environment in engineering education is of social importance and includes communication and interaction between all participants of the educational

process. The process of interaction between the student and the information environment can be interpreted in two ways. On the one hand, the information environment affects the formation of the learner as a person through its components, and on the other hand, it is implemented by the information education environment when entering into relations with other subjects of the environment. The information educational environment for teaching technology should provide all subjects with opportunities to effectively develop and demonstrate their activities. As students interact with the components of this environment, they modify it to suit their abilities and needs. The more opportunities students have, the more successful their development will be.

During the video conference held under the chairmanship of the President of the Republic of Uzbekistan on June 20, 2024, regarding "Training of personnel in the field of engineering and further improvement of the activities of higher educational institutions", the President of the Republic of Uzbekistan said that the issue of cost reduction in industry is very relevant today in the world. Or, through benchmarking, best practices and achievements are analyzed, modeled and implemented in production. "Reverse engineering" is the practice of taking a finished product, breaking apart the working mechanism, and creating a similar product without infringing copyright. The President noted with regret that training for them was not started in any technical university [2].

As the President noted, in today's era of rapid development of science and education, there is a need to train separate engineers not only in cost engineering, benchmarking engineering, re-engineering, but also modern terms that are used alongside the term engineering: cost engineering, benchmarking engineering and "re-engineering". (Reversive Engineering) requires engineering skills to be one of the important aspects to be considered in the professional development of future engineers.

After all, regardless of the field in which engineers are trained, if the qualification requirements of that field are analyzed in detail, it becomes clear that the requirements corresponding to the skills of cost engineering (Cost

Engineering), benchmarking engineering (Benchmarking Engineering) and "Reversive Engineering" are set among the professional competencies set for future engineers.

Below, we have analyzed the content of the terms cost, comparison and re-engineering and the corresponding requirements for these skills from the professional competencies listed in the qualification requirements of the bachelor's degree in Technological processes and automation and control of hydraulic production, which we have selected in our research.

Cost engineering (Cost Engineering) is an engineering discipline that deals with accurate calculation, analysis and optimization of the cost of a product, service or project.

The main goals of cost engineering: to make the project or product economically efficient; rational use of resources; is to reduce costs while maintaining quality and create a basis for pricing.

The main work processes of cost engineering are: costing - accurate calculation of each process, material, labor and technology; analysis - to determine at which stages there are excess costs; optimization - reducing costs by changing technology, using energy-efficient equipment or replacing materials; forecasting - predicting cost and price changes in accordance with future market conditions.

Among the professional competencies listed in the qualification requirements of the bachelor's degree in technological processes and automation and control of hydraulic production, the following are suitable for cost engineering:

- analysis and optimization of economic efficiency of production processes.
- calculation of resource consumption (raw materials, energy, time) for technological processes.
- development of technical and economic bases of projects.

Cost engineering requires knowledge and skills in planning, calculating and optimizing costs in production and service systems. These competencies in the qualification requirements create the basis for the engineer to work as an economic analyst.

Research Scientist Rongrong Du (China) Future engineers should follow the development of the times, continuously study and reform the teaching method, and develop the comprehensive quality and practical ability of students. At the same time, the author emphasizes the need to organize professional practices for future engineers to develop their professional skills in cost engineering [3].

According to Barry Boehm (USA), effective use of cost forecasting software in training engineers will provide students with a solid theoretical basis for product cost forecasting, parametric modeling and predictive models in cost engineering training - in an informed environment[4].

The British scientist Joas Serugga (Birmingham City University) conducted research on the training of future engineers in an informational educational environment and developed online platforms for creating cost models based on modules, in which students have the opportunity to perform real practical exercises [5].

Table 1

Modern engineering terminology and professional competencies listed in qualification requirements

Modern engineering term	Description	Professional competencies listed in qualification requirements
Cost Engineering	is a field of engineering that deals with accurate calculation, analysis and optimization of the value of a product, service or project.	- analysis and optimization of economic efficiency of production processes. - calculation of resource consumption (raw materials, energy, time) for technological processes.

		- development of technical and economic bases of projects.
Benchmarking Engineering	is an engineering branch aimed at determining the most effective, reliable and economically viable option by comparing and analyzing different technical systems, structures, equipment, production processes or technologies.	- analysis of technological processes and their comparison with advanced foreign experience; - assessment of production quality based on standardization and certification requirements; - to determine the possibilities of applying new technologies to existing systems.
"Re-engineering" (Reversible Engineering)	It is the ability to restore the original design of a finished product, equipment or system by analyzing its structure, working principle and technical documents from the finished form.	- radical redesign of production or management processes; - introduction of modern automation systems to increase labor productivity in technological processes; - modernization of production processes based on innovative technologies.

Benchmarking Engineering is an engineering discipline aimed at determining the most effective, reliable and economically viable option by comparing and analyzing different technical systems, structures, equipment, production processes or technologies.

Competencies corresponding to the qualification requirements of the bachelor's degree in technological processes and automation and control of hydraulic production:

- analysis of technological processes and their comparison with advanced foreign experience;
- assessment of production quality based on standardization and certification requirements;
- to determine the possibilities of applying new technologies to existing systems.

Benchmarking is an analytical approach aimed at comparing technological solutions in terms of quality, efficiency, cost and environmental performance. These competencies in the qualification requirements form students' analytical thinking and technological benchmarking skills. The informed educational environment allows this to be done through analytical tools such as Power BI, Tableau, and MATLAB Comparison Toolbox.

Professional competencies listed in the qualification requirements of the Bachelor's course of Modern Engineering and Automation and Control of Technological Processes and Production (Table 1):

Reverse engineering is the skill of restoring the original design of a finished product, equipment or system by analyzing its structure, principle of operation and technical documents, starting from the finished form.

Competencies corresponding to the qualification requirements of the bachelor's degree in technological processes and automation and control of hydraulic production:

- radical redesign of production or management processes;
- introduction of modern automation systems to increase labor productivity in technological processes;
- modernization of production processes based on innovative technologies.

Re-engineering is a strategy to radically improve production, service or management systems in terms of quality, speed and cost. Competencies listed in the qualification requirements prepare students for a creative engineering approach in this area. The informed educational environment supports this through BPMN modeling tools (Bizagi, ARIS), simulation programs (Arena, AnyLogic).

Development of professional skills in future engineers, the ability to think outside the box, quick and accurate decision-making, critical thinking of problems, the ability to manage behavior and own activities, the ability to work with various resources, and the presence of professional qualities such as competitiveness are of particular importance in increasing the competitiveness of engineers.

Foreign pedagogues say that the main pedagogical problem in the professional development of engineers is the disconnection between theory and practice. They propose a solution to this problem through "experiential learning" and "competency-oriented programs".

CIS scientists attribute the pedagogical problem in engineering education mainly to the lack of personal development and professional identity. In their opinion, an individual and person-oriented approach is important in engineering education.

In the modern understanding, an engineer is a highly educated specialist who, relying on theoretical knowledge, professional skills, and operational characteristics, ensures maintenance, modification and creation of technical, technological and other systems in a working condition with specified performance indicators.

An engineer in a technical system is a highly educated specialist who, relying on theoretical knowledge, professional skills, and business qualities, creates, modifies, and maintains technical, technological, and other systems with the required (given) performance.

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