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PROFESSIONAL DEVELOPMENT OF PETROLEUM ENGINEERS IN LIFELONG EDUCATION

Abstract. *The article deals with the urgent issues of the development of lifelong professional education, state policy implementation directed to the*

petroleum engineers' training. The essence, content and structure of future engineers professional training with the aim of formation professional competence are highlighted in this article. The features of cognitive and practical activities of future experts in petroleum industry are revealed. The constituents and conditions for increasing the efficiency of forming the professional competence of a petroleum engineer and his willingness are defined. The impact of globalization challenges to ensure qualitative training of future petroleum engineers to meet requirements and needs of national and regional labour markets is analysed. A great attention is given to the importance of prediction of lifelong professional education development, strengthening of forecast scientific research function. The specific features of forming the content of training and the application of innovative and advanced pedagogical technologies are identified. The interaction of economic, scientific and technical factors being considered in training experts for petroleum industry is outlined. In order to estimate efficiency of this training interdisciplinarity is essential. The necessity of using interdisciplinary educational technologies in the professional training of future petroleum specialists is substantiated. The significance of interdisciplinarity in education under the condition of sharp growth in information activity and the increased role of intellectual property items in modern economy are shown. It has been found that interdisciplinarity of petroleum education is based on the network interrelations of the studied disciplines. The goal, content, and trends in interdisciplinarity of petroleum education are presented in the system of petroleum training. The study has confirmed that interdisciplinary integrity in petroleum industry boosts the development of international collaboration and intercultural cooperation.

Key words: *lifelong petroleum education; an engineer of petroleum industry; professional education and training, qualification, the internationalization of knowledge; state educational policy; labour market; forecast; practice; technologies; upgrading.*

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ПРОФЕСІЙНИЙ РОЗВИТОК ІНЖЕНЕРІВ НАФТОГАЗОВОЇ ГАЛУЗІ У НЕПЕРЕРВНІЙ ОСВІТІ

Анотація. У статті розглядаються актуальні питання розвитку неперервної професійної освіти, реалізації державної політики, спрямованої на підготовку інженерів нафтогазової галузі. Висвітлено сутність, зміст і структуру професійної підготовки майбутніх

інженерів-нафтовиків із метою формування фахових компетенцій. Розкрито особливості пізнавально-практичної діяльності майбутніх фахівців нафтогазової галузі. Визначено складові та умови підвищення ефективності формування професійної компетентності інженера-нафтовика та його готовності. Проаналізовано вплив глобалізаційних викликів на забезпечення якості професійної підготовки майбутніх інженерів нафтогазової галузі відповідно до вимог і потреб національного та регіональних ринків праці. Привернуто увагу до важливості прогнозування розвитку неперервної нафтогазової освіти, посилення прогностичної функції наукових досліджень. Визначено особливості формування змісту підготовки та використання інноваційних педагогічних технологій. У статті розглядаються основні аспекти взаємодії науково-технічних та економічних чинників, які враховуються при підготовці нафтогазових кадрів. Розглянуто основні аспекти взаємодії науково-технічних та економічних чинників, які враховуються при підготовці кадрів нафтогазової галузі. У контексті вирішення проблем наголошується на використанні міждисциплінарності задля ефективності навчання. Обґрунтовано необхідність застосування міждисциплінарних освітніх технологій у процесі підготовки фахівців нафтогазової справи. Показана важливість міждисциплінарності освіти в умовах різкого росту інформаційної активності та зростання ролі об'єктів інтелектуальної власності в сучасній економіці. Виявлено, що міждисциплінарність нафтогазової освіти ґрунтується на мережевих взаємовідносинах виучуваних дисциплін. Наведено мету, зміст, спрямованість міждисциплінарності освіти в системі нафтогазового навчання.

Ключові слова: неперервна нафтогазова освіта; інженер нафтогазової галузі; професійна освіта і навчання; кваліфікація; інтернаціоналізація знань; державна освітня політика; ринок праці; прогнозування; практика; технології; модернізація.

Introduction. The petroleum industry has particular strategic impact both on economic development of the country and Ukrainian society generally. In recent years, it is under transitional conditions to a new technological level on the basis of innovative partnership formation of state, business, Ukrainian science and education. In the epoch of global changes in the Ukrainian society, higher vocational education is becoming one of the large scaled and most crucial spheres of the professional education system in the country. In this regard, petroleum industry engineers' training, particularly ways of its effective development are becoming the most significant tasks of state educational policy.

Transition of the petroleum industry to a qualitatively new technological level requires petroleum engineers with formed cultural and professional competencies, which are indicated in the state educational standards of higher professional training by petroleum engineering direction, providing their active participation in the development and implementation of scientific and intensive technologies for the effectiveness of this transition. A great deal of the petroleum engineers' training to their future professional activities' implementation is the result of fundamental disciplines' cycle studying, which includes maths, chemistry, physics, geology in the process of studying of which they obtain a holistic system of professional competence, knowledge and skills in the occupation field, the ability to acquire methods for solving professional tasks, as their career life as petroleum engineers are connected with the development and implementation of projects, small groups works' designing, implementation of project tasks involving the technical knowledge [8].

The future petroleum engineer forming in the educational process takes place in the connection of personal and professional growth (wishes, essentialities, intentions, targets, duties) and external learning. The function of an educator is to create the appropriate educational conditions and to apply adequate pedagogical technologies to help the students in comprehending and realizing the requirement of self-perfection, to develop the professional and personal features that are crucial in their future professional activities, in particular, to train competitive and proficient specialists on the labor market. It demands possibilities' and conditions' theoretical rationalization of future experts' professionally significant characteristics at different stages of training in various disciplines' learning process at higher educational establishments.

Literature Review. Theoretical and methodological aspects of our study are based on standout works by the outstanding scholars like M. Barth, S. Babidge, J. Boynton, D. Chan, A. Cortese, C. Didier, J. Frynas, R. Huet, D. Hussey, P. Kirsop, C. McClelland, R. Meissen, J. Smith and others are keen to teach the future generation of petroleum engineers to be well-rounded professionals who consider the technical and social aspects and the broader effects of their activities. Their researches include pedagogical interventions in labs and lecture rooms, comprising how to teach technical and professional competence.

The petroleum industry introduces peculiar callings to its specialists who are occasionally obliged to operate contesting general patterns and codes of behaviour, various commitments, shared beliefs, values and duties, the importance of individual dignity, social responsibility approaches of their management (M. Blowfield, J. Boutelle, L. Bucciarelli, S. Costa, G. Catalano, D. Douglas, J. Frynas, M. Scoble and others). In short, the competence of social responsibility is the contemporary prevailing core taken by the petroleum

sector to develop companies' commitments to all their collaborators because it has a slight part in petroleum ethics training.

Our study is aimed at analyzing professional development of the future engineers for petroleum industry in continuing training and revealing the procedure of acquiring and forming these experts' professional competence.

To reach the objective of the study we have used such methods as theoretical analysis, systematization, generalization, synthesis, comparative analysis.

Results. By "petroleum engineers' professional competence" we mean a complex integrated system of specialists' professional competences, reflecting the synthesis of technical and engineering knowledge, abilities, skills, intellectual abilities, the value orientations' aggregation, action programs, motivations and needs in professional self-improvement, which are manifested in professional activity of a petroleum engineer, related to technical and technological projects' design and prediction. So, the development of cognitive interests' and students' educational motivation to study fundamental disciplines; integration of educational and research activities; the forming of students' skills in designing activity; an advanced entry into the future professional activity; evolution of reflective and evaluative skills.

Functions of professional competence' forming of the future petroleum engineers in the educational process are: 1) developmental function due to the educational objectives aims to raise the future specialists' general development level are defined, creativity, to identify and eliminate their causes critical thinking, ability to analyze and find the right solution, the willingness to overcome difficulties are formed, educational activity is initiated; 2) raising function regards as future engineers' sense of responsibility, collaboration, essentials of selfawareness, self-esteem, assertiveness in training activity, independence, commitment to the achievement of the target; 3) the classification function presents the ground of a differentiated facet, learners are divided into subgroups by training level during their training at university, which helps to intensify the process of students' education and self-education, select their individual learning plans, the selection of perspective students with regard to their potential and further targeted training that considers the current labour market demands; 4) professional orientation function illustrates conscious awareness of continuing education and self-development's need for a prosperous professional life; 5) advancing innovation function indicates petroleum engineers' capability to form their professional activities and willingness to combine a career with continuing education, duties to innovative entrepreneurship [8].

According to N. Nychkalo theoretically well-grounded standards of integration and at the same time specialization in pedagogical sciences, as well

as globalization in pedagogy and education, are extremely significant. Particular attention should be paid to scientific problems, analysis of genesis and modern categories of specialization and integration. There is no doubt about the interdependence of these concepts, which, at first glance, are contradictory and even, sometimes mutually exclusive [5, p. 37]. Under these conditions, the primary task is to address to the urgent problems of modern education philosophy, uniting the efforts of representatives of scientific knowledge in different fields to carry out theoretical and methodological researches.

Taking into consideration that a petroleum engineer serves as a bridge between science, engineering, and the business world we can assume that the most significant constituent of petroleum engineers' professional competence is a synthesis of such competence as special fundamental knowledge, skills and personal qualities necessary for the specialists' effective fulfillment of their professional duties, particularly, for the successful implementation of engineering projects, requiring the fulfillment of technical calculations, abilities, allowing to operate in professional activity effectively, to be guided in work situations successfully, to adapt to changing manufacturing conditions in various work groups. Thus, the urgent need appears to develop future petroleum engineers' methodical training regulation in the process of professional cycle disciplines, which differs from the traditional approaches in assessing personal growth of a petroleum engineer and his willingness to perform his job. That is to say, the educational system ought to be sensitive to the diversity in science, technics and technologies, that, undoubtedly, result in advances in petroleum engineer's professional activities.

On the whole, a society of competitive structure needs personnel ready and capable of inventory, innovative, managerial and rationalization activity, possessing interdisciplinary knowledge and tools of generating a reliable and effective solution with high level of novelty (petroleum engineering education), innovativeness (social and commercial efficiency), reliability and responsibility, and strategies in advance of invention "resource" in the professional petroleum sphere.

Modern training of a petroleum engineer requires the integration of fundamental natural sciences and technical knowledge with the ability to perform specific tasks and developments ensuring their rapid usage in real life. A substantial role in the development of innovative approaches to the problem of organizing petroleum engineers training in modern conditions of high information satiety of the educational process belongs to engineering pedagogy.

Petroleum engineering assures that energy will keep to be a main part to social operation and person's common activities. Petroleum experts resolve vital issues that donate to energy safety and public welfare. However, there are certain limitations in engineering evolution from a purely technical viewpoints

[7]. The essential point of Lori's analysis is that interdisciplinarity ought not to be a crew of people where everybody is a professional on everything; but it is a team of people from various fields of study in the same location; developing the tools for everything that is required in all areas; forming of information exchange. Lori [2, p.33] draws attention to the role of idea-filtering communication that is valuable, permitting helpful data evolve into institutional information, which is the real prosperity of an establishment.

Modern engineers are professionals whose activity directly influences the technological infrastructure of a society. As stated by National Guidelines for Engineering Education petroleum engineers "are able to use both your analytical and creative skills to solve socially valuable technological problems. They have to work innovatively, structurally, and diligently; have to analyze, generate solutions, assess, determine, execute, and report – be a good entrepreneur" [3]. In addition to natural science and technological subjects, for petroleum engineers linguistic skills are important, both written and oral, both in mother tongue and in foreign languages. Interacting systems are essential to the modern society, and experts in hydrocarbon field must thus be skilled at working independently as well as in teams with engineers from their discipline and from others, professionals from other fields, and in interdisciplinary teams. Besides, petroleum engineers work with people, so they have ethical and environmental responsibilities and a significant impact on society. Also, petroleum professionals need to enjoy the challenge of working in a unique focused environment. To put it another way it is of great importance to realize how innovative competence within their field because of the arrangement of competence applied on-site in the extraction of oil and gas, both onshore and offshore.

Conclusion. All things considered, competency development in petroleum engineers is a life-long process. It starts with the undergraduate education and continues on throughout the career of the petroleum engineer. The main competencies include dimensions not found in traditional petroleum engineering and geoscience programs such as leadership, health, safety and environment, interdisciplinary and intercultural competence. Furthermore, the interdisciplinarity of petroleum education is based on network interaction of studied disciplines. It is pedagogical integration in the complex of natural, engineering, technological, mathematical, social, economic, legal, philosophic, and language knowledge. Besides, it develops a uniform, integrated, dynamically interactive, dialectic and synergetic, fractal and holographic existence image and relevant mode of thinking. Improvement of petroleum engineering education due to its interdisciplinarity introduces the relevant content of invariant part of petroleum learning process which is so necessary in modern conditions, when one should response to new social challenges, new

technologies, and new markets quickly and adequately, making decisions in the unbalanced condition of uncertainty keeping balance of mobility and stability. Also, transition to interdisciplinarity of education is neither technological nor conceptual one. It is the problem of values, rational will, and choice.

Our research has shown that leadership training at the undergraduate level is a key need for future readiness of petroleum engineering students. The remaining core competencies, health, safety and environment, interdisciplinary and intercultural competency, are mostly learned at the workplace. Both university educators, corporate trainers and managers need to adapt their pedagogical methods to build competencies in Generation Y petroleum engineers.

Further studies should cover the problem of forming intercultural communicative competence of future petroleum engineers in leading European countries.

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