ENGINEERING AND PEDAGOGICAL EDUCATION IN THE CONTEXT OF CONTEMPORARY EDUCATION REFORM

ІНЖЕНЕРНО-ПЕДАГОГІЧНА ОСВІТА В КОНТЕКСТІ СУЧАСНОЇ РЕФОРМИ ОСВІТИ

UDC 378
DOI https://doi.org/10.32782/2663-6085/2025/83.2.5

Medvedovska T.P.,
Candidate of Pedagogical Sciences,
Associate Professor,
Deputy Director
Interbranch Institute of Continuing Education, Full-time Distance Education,
Associate Professor at the Department of Philosophy and Pedagogy
Dnipro University of Technology

This article highlights the critical need to reform engineering and pedagogical education in Ukraine, driven by the need to align it with European standards and global trends. The current legislative framework, including the laws "On Education" and "On Higher Education", requires a fundamental shift from the simple accumulation of theoretical knowledge to a practically oriented, competency-based approach. This transformation is particularly important for vocational education, which aims to train highly qualified, adaptable professionals who are ready to meet modern challenges and respond to the dynamic needs of the global labor market. The rapid pace of technological progress requires educators who are not only knowledgeable, but also flexible and innovative in their teaching methods. The study carefully outlines key strategies for modernizing vocational training, with an emphasis on creating a truly innovative educational environment. This environment is carefully designed to develop not only basic knowledge, but also essential 21st century skills such as critical thinking, problem-solving, adaptability, and professional mobility among future engineering teachers. Considerable and focused attention is paid to the integration of advanced pedagogical technologies, in particular the development of critical thinking and problem-based learning, as these methods are extremely important for promoting deeper intellectual understanding, active student participation, and preparing graduates to overcome multifaceted real-world scenarios.

In addition, the article delves into practical, effective methods for creating new technical solutions, effectively solving complex creative tasks, and carefully organizing students' independent work. These elements are clearly considered necessary for the upbringing of a well-rounded, creative, and professionally competent personality. The paramount importance of achieving a harmonious and effective balance between strong theoretical knowledge and its practical application is emphasized; for the widespread implementation of innovative tools and digital technologies in both social and humanitarian and professionally oriented disciplines, providing a holistic and promising educational experience. The synergy that arises because of the effective combination of innovative and traditional teaching methods is presented as a fundamental cornerstone for the preparation of highly qualified specialists who are not only capable of sustainable professional growth but also know how to initiate and manage innovative activities. The conclusion states that a systematic, creatively directed and deeply student-oriented approach, which is regularly used in the professional training of teachers of engineering specialties, carefully aligns all educational efforts with modern, changing labor market requirements, pressing modern educational challenges and general priorities of national development, thereby ensuring Ukraine's competitive advantage in the global arena.

Key words: *the engineering-pedagogical education, the innovation environment, the technologies, the teaching methods, the educational process.*

У цій статті підкреслюється критична потреба реформування інженерно-педагогічної освіти в Україні, що зумовлена необхідністю її узгодження з європейськими стандартами та світовими тенденціями. Чинна законодавча база, включаючи закони «Про освіту» та «Про вищу освіту», вимагає фундаментального переходу від простого накопичення теоретичних знань до практично орієнтованого, компетентнісного підходу. Ця трансформація особливо важлива для професійної освіти, метою якої є підготовка висококваліфікованих, адаптивних фахівців, готових до сучасних викликів та реагування на динамічні потреби світового ринку праці. Швидкі темпи технологічного прогресу вимагають від педагогів не лише знань, але й гнучких та інноваційних у своїх методах викладання. У дослідженні ретельно окреслено ключові стратегії модернізації професійної підготовки з акцентом на створенні справді інноваційного освітнього середовища. Це середовище ретельно розроблене для розвитку не лише базових знань, але й необхідних навичок 21-го століття, таких як критичне мислення, вирішення проблем, адаптивність та професійна мобільність серед майбутніх викладачів інженерних спеціальностей. Значна та цілеспрямована увага приділяється інтеграції передових педагогічних технологій, зокрема розвитку критичного мислення та проблемного навчання, оскільки ці методи надзвичайно важливі для сприяння глибшому інтелектуальному розумінню, активній участі студентів та підготовки випускників до подолання багатогранних реальних сценаріїв.

Крім того, у статті розглядаються практичні, ефективні методи створення нових технічних рішень, ефективного вирішення складних творчих завдань та ретельної організації самостійної роботи студентів. Ці елементи однозначно вважаються необхідними для виховання всебічної, творчої та професійно компетентної особистості. Підкреслюється першочергове значення досягнення гармонійного та ефективного балансу між міцними теоретичними знаннями та їх практичним застосуванням; для широкого впровадження інноваційних інструментів та цифрових технологій як у соціально-гуманітарних, так і в професійно орієнтованих дисциплінах, що забезпечує цілісний та перспективний освітній досвід. Синергія, що виникає в результаті ефективного поєднання інноваційних та традиційних методів навчання, представлена як фундаментальний наріжний камінь для підготовки висококваліфікованих фахівців, які не лише здатні до сталого професійного зростання, але й знають, як ініціювати та керувати інноваційною діяльністю. У висновку зазначається, що системний, творчо спрямований та глибоко студентоорієнтований підхід, який регулярно використовується у професійній підготовці викладачів інженерних спеціальностей, ретельно узгоджує всі освітні зусилля із сучасними, мінливими вимогами ринку праці, нагальними освітніми викликами та загальними пріоритетами національного розвитку, тим самим забезпечуючи конкурентну перевагу України на світовій арені.

Ключові слова: *інженерно-педагогічна освіта, інноваційне середовище, технології, методи навчання, освітній процес.*

Statement and justification of the relevance of the problem. Integration into the European and world community actualizes the need to reform various sectors of public life in Ukraine, in particular, approaches to the reorganization of higher education, the transition from relay pedagogical technologies to the design of pedagogical processes, the acquisition of vital competencies by students by abandoning the simple accumulation of theoretical knowledge and moving to practice-oriented education, require development.

The main directions and ways to improve the educational process in higher education institutions are defined in the laws of Ukraine «On Education», «On Higher Education», «On Vocational and Technical Education», etc. The above legislative and regulatory legal acts record the need to solve tactical and strategic tasks of professional activity, one of the ways of which is the reorganization of the system of secondary, higher and vocational education.

Vocational and technical education is of particular importance at the present stage, since the need to train highly qualified workers capable of personal and professional self-development, ready to respond to the challenges of today, is becoming more urgent.

To improve the quality and competitiveness of vocational education, in accordance with the needs of European society and the domestic economy, the above-mentioned documents define the legal, organizational and financial principles for the functioning and development of vocational education institutions; indicate how to create conditions for professional self-realization of the individual and ensuring the needs of society and the state in qualified workers.

However, it is necessary to formulate practical recommendations aimed at implementing the provisions of regulatory documents.

Analysis of research and publications. The problem of training professionally competent and creatively active personnel is relevant today, but not new. An analysis of modern scientific publications made it possible to state several shortcomings of the dominant educational vocational and technical sector (especially the higher education sector), in addition, these and many other publications proposed numerous new approaches to its modernization.

L. Tarkhan characterized modern educational technologies of engineering and pedagogical training [5].

I. Dychkivska outlined innovative pedagogical technologies in the context of national trends in reforming the educational sector [2].

S. Strilets investigated theoretical and practical aspects of introducing innovative technologies into higher pedagogical education [4].

At the same time, we encounter concerns among theoretical scientists and practitioners about how diverse innovative technologies, methods, and tools are natural in the context of the country's development history, the mentality of Ukrainians, and their readiness for change, because it is easy to lose the existing accumulated experience, which has been defined as positive for many years. That is why there is a need to analyze the proposed approaches and predict their impact on the development of the education system in Ukraine.

The purpose of the work is to characterize possible ways to improve the professional training of future engineering teachers in the context of educational reform.

Presentation of the main material. At the current stage of development of higher education, there is a rethinking of the value of knowledge that students acquire in the process of professional training. This is due to the needs of society in creative specialists who can independently navigate the rapid flow of scientific and technical information, ready to think critically, produce and defend their point of view.

To implement the tasks set forth in state documents, it is necessary to reorganize the system of professional training of future engineer-teachers who will be able to reform the educational process in vocational education institutions, as well as train competitive skilled workers.

In our opinion, the improvement of professional training of future engineering teachers is directly related to the creation of an innovative environment in educational institutions, the main features of which, according to V. I. Khymynets [6], are as follows: democracy – the ability to take into account different approaches, collegiality in decision-making; a situation of choice (creation of several options for programs, activity models, technologies that provide the prerequisites for a conscious choice); self-realization (disclosure of the personal potential of each participant in the pedagogical process); co-creation (joint activity of subjects who strive to achieve new quantitative and qualitative results); synergy (non-linearity, instability as procedural characteristics and self-organization of the system of scientific and methodological support).

Thus, the design of an innovative educational environment involves the introduction of new managerial relationships and structures, the creation of optimal conditions for the interaction of an educational institution with society, the formation of a new worldview of teachers, and the development of new educational technologies.

It should be noted that educational technologies, original educational ideas, forms and methods of education, non-standard approaches in management are the result of a creative search by theorists-pedagogues and teachers-practitioners for original, non-standard solutions to various pedagogical problems.

In this context, the teaching staff of higher education institutions must find a balance between

theoretical and practical training, traditional and innovative forms, methods and means of teaching.

That is why, in the context of modern processes of reforming the higher education system, traditional teaching methods are being updated based on considering the processes of informatization and computerization, as well as testing and implementing innovative technologies, methods and means.

In pedagogical science at the present stage, the following pedagogical technologies are becoming widespread: problem-based learning technology, game-based learning technology, personally oriented learning technology, developmental learning technology, collective learning technology, critical thinking development technology, program learning technology, interactive learning technology, project technology, modular learning technology, collective, creative education technology.

There is a need to analyze individual technologies, the use of which in the professional training of future engineer-teachers will make it possible to reorganize the educational process in higher education institutions and increase the level of vocational education.

It should be noted that learning technology is a set of methods, means and implementation by people of a specific complex process by dividing it into a system of sequential interconnected procedures and operations that are performed unambiguously and are aimed at achieving high efficiency of a certain type of activity [1].

One of the most popular at the present stage is the technology of developing critical thinking [1; 2], the purpose of which is to teach future engineering teachers to perceive educational material in a special way: the information that the student acquires must be correlated with his own experience, and on this basis form a certain analytical judgment.

As a result of the application of critical thinking development technology, future engineering teachers should have the skills to work with information, find it in various sources, analyze, use the necessary information, and not just memorize it; the ability to think critically, solve problems. They should be ready to become mediators in resolving interpersonal and other conflicts and learn to think positively and actively.

The application of the technology of developing critical thinking in the professional training of future engineering teachers involves the sequential implementation of three stages. First, cognitive processes are updated based on the acquired knowledge and experience.

At the same stage, it is important to encourage students to actively do cognitive activity, to stimulate interest in the problem raised. At the second stage, awareness and assimilation of new information occurs by listening to lectures, studying the text, watching a film, etc.

The teacher must maintain students' interest, stimulate them and monitor the assimilation of new knowledge [1; 2]. The third stage involves students' comprehension (reflection) of new material, adaptation of new concepts to their own system of knowledge, that is, changing already formed ideas and restructuring the formed connections, which will provide a place for new information.

It is at this stage that students should be encouraged to explain the educational material in their own words, because knowledge is better absorbed if it is formed in its own context. In addition, it is necessary to promote the exchange of ideas between students. This will also stimulate mental activity and increase interest in the topic.

The technology of critical thinking in the process of training future engineer-teachers can be applied in the context of various disciplines, both the social and humanitarian cycle and professional and practical training. Students should be encouraged to express different opinions and views on any educational problem.

And at the same time, they should be taught the ability to make their own choices. The material for such a situation can be educational tasks and pedagogical situations, excerpts from scientific articles, videos, etc. To find the answer to the question, students should use different sources of information, analyze different points of view, and draw their own conclusions.

In addition, in the educational process of higher education institutions, the technology of problem-based learning is increasingly being used, which can be characterized as a holistic didactic system based on logical and psychological laws of creative knowledge acquisition in educational activities [2].

The technology of problem-based learning involves the widespread use of problem-based learning methods. In pedagogy, many classifications of problem-based learning methods have been developed.

Depending on the method of presenting educational material (problem situations) and the level of activity of students, six methods have been identified: the method of monological presentation, the method of reasoning, the dialogical method of presentation, the heuristic method of learning, the research method and the method of programmed tasks [2].

The first three groups of methods are based on the presentation of educational material by the teacher; the second three groups are based on the organization of independent educational activities of pupils (students). Each of these groups of methods provides for an increase in the level of activity of pupils (students) and, therefore, the problematic nature of learning.

This is due to the rapid growth of the volume of information in the scientific world: future specialists

must learn the main approaches to solving the tasks set before them. At the same time, knowledge must be of a purely scientific, clearly systematized, creative nature. Future engineer-teachers must be able not only to apply this knowledge in various fields, but also to independently improve their professional level.

The purpose of problem-based learning technology is to teach future engineer-teachers to independently search for independent original solutions, obtain and apply the necessary information, critically evaluate it, and draw their own conclusions and generalizations.

In addition, in the process of creating an innovative environment in higher education institutions that provide professional training for future engineering teachers, it is advisable to use other methods and techniques of training within the framework of the described technologies.

Let us dwell in more detail on those methods that, in our opinion, are most appropriate for use in the context of creating an innovative environment in higher education institutions. First, it is worth analyzing the methods of searching for new technical solutions.

They are an effective means of developing a creative personality and professional skills [2]. The above methods involve the selection of ways to solve a problem, covering a set of techniques of mental activity, as well as operations for collecting, analyzing, processing and storing the necessary information.

At the current stage, methods for searching for new technical solutions are used to implement useful, neutralize or weaken unnecessary external functions of an object, and, if necessary, to synthesize new or improve existing systems.

In addition, at the present stage there are quite effective methods for solving creative problems, which can be conditionally combined into two main groups. The methods of the first group are based on associative thinking and the random nature of scientific research.

These include: the trial-and-error method, brainstorming, Synectic, the method of control questions, the method of focal objects, and morphological analysis.

The methods of the second group are more difficult to use, but they are directly related to the essence of the object under study. They provide a scientifically based algorithm of the creative process. The methods of this group primarily include the algorithm for solving inventive problems and functional-value analysis.

In the research process, the project method acquires special importance, aimed at developing students' cognitive and creative skills, the ability to independently construct their knowledge, navigate the information space, and think critically [1]. The purpose of using this method is to form skills for the effective use of information and communication technologies in the process of independent (individual or group) research and search activities of students.

Today, the most important and most effective method of learning is the organization of independent creative activity of the student.

The main goal of independent cognitive activity of the future engineer-teacher is the formation and self-development of a creative personality through independent processing of scientific and methodological literature, innovative creative solutions to inventive tasks, improvement of old and creation of new technological processes through improvement and modernization [3].

Independence is the activity that the student carries out without external direct assistance, relying on his knowledge, thinking, skills, life experience, beliefs, and which, due to the enrichment of the future specialist with knowledge, contributes to the formation of readiness for independent activity.

Therefore, in the process of professional training of future engineering teachers, it is worth applying different methods, because none of them is universal, that is, it is practically impossible to solve various creative pedagogical and technical tasks by limiting oneself to one method.

The use of these methods in the educational process also involves reviewing educational tasks, which are one of the effective didactic means of developing the creative abilities of future engineering teachers.

Conclusions and suggestions. Thus, summarizing the above, we emphasize that the creation of an innovative environment in higher education institutions that train future engineer-teachers is a complex, complex problem that involves the development of new concepts, ideas and approaches, as well as the improvement of technologies, forms and methods of transferring knowledge and skills.

Modification of traditional and development of new methodological tools should be carried out based on considering the specifics of the future professional activities of specialists, trends in the development of the educational industry at the current stage, and the peculiarities of the organization of the educational process in each higher education institution.

REFERENCES

1. Буйницька О. П. Інформаційні технології та технічні засоби навчання : навч. посіб. Київ, 2012. 240 с.

2. Дичківська І. М. Інноваційні педагогічні технології. Київ, 2015. 304 с.

3. Солдатенко М. М. Теорія і практика самостійної пізнавальної діяльності : монографія. Київ, 2006. 198 с.

4. Стрілець С. І. Інновації у вищій педагогічній освіті: теорія і практика : навч. посіб. для студ. вищ. навч. закл. Чернігів, 2013. 508 с.

5. Тархан Л. З. Теоретичні і методичні основи формування дидактичної компетентності майбутніх інженерів-педагогів : автореф. дис. … д-ра пед. наук : 13.00.04. Київ, 2008. 42 с.

6. Химинець В. В. Інноваційна освітня діяльність. Тернопіль, 2009. 360 с.