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Серія «Культура і мистецтво», Серія «Історія та археологія»)***

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Журнал публікує наукові розвідки з теоретичних та прикладних аспектів філології, соціології, науки про освіту, історії, археології, а також, культурології та мистецтвознавства з метою їх впровадження у сучасний науково-освітній простір.

Цільова аудиторія: вчені, лінгвісти, літературознавці, перекладачі, мистецтвознавці, культурознавці, педагоги, соціологи, історики, археологи, а також, інші фахівці з різних сфер життєдіяльності суспільства, де знаходять застосування тематика наукового журналу.



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- ✚ Литвинська Світлана Віталіївна - кандидат філологічних наук, доцент, завідувач кафедри української мови та культури Національного авіаційного університету, (Київ, Україна)



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Movmyga Nataliia Evgenivna PhD of Psychology, Associate professor, Department of Occupational and Environmental Safety, National Technical University «Kharkiv Polytechnic Institute», Kyrpychova St., 2, Kharkiv, 61002, tel.: (095) 393-06-39, <https://orcid.org/0000-0002-7207-8558>

Polezhaieva Olena Viktorivna Senior Lecturer, Department of Pedagogy, Foreign Philology and Translation, S. Kuznets Kharkiv National University of Economics, Nauki Ave. 9a, Kharkiv, 61165, tel: (067) 771-81-42, <https://orcid.org/0000-0002-3178-6339>

Gyrenko Iryna Viktorivna PhD, Associate Professor, Department of Occupational and Environmental Safety, National Technical University «Kharkiv Polytechnic Institute», Kyrpychova St., 2, Kharkiv, 61002, tel.: (099) 027-09-02, <https://orcid.org/0000-0001-6074-937X>

USE OF STEM TECHNOLOGIES IN THE EDUCATIONAL PROCESS IN THE TRAINING OF TECHNICAL PROFILE SPECIALISTS

Abstract. This article examines the relevance and necessity of introducing an innovative approach to modern education which is called the STEM-approach and is focused on the formation of students' skills in scientific research, engineering, invention, entrepreneurship, and professional self-determination. Today, higher education should provide training of specialists with professional skills that reflect their professional competence, social orientation, values and ability to satisfy personal and social needs, i.e. persons with such a professional level that would meet modern international requirements and standards. The authors analyzed the essential characteristics of the STEM approach as a new and innovative mechanism of transformation of modern higher education through science. The necessity to introduce STEM technologies into the educational process of technical specialists was determined. The advantages of their absorption were identified and the stages of professional education of technical specialists with the help of STEM technologies were determined. The article outlines the need for this application in the perspective of the considered problem. It is determined that STEM education with the help of practice-oriented methods opens up the



ways of development and application of scientific and technical knowledge for professional growth to specialists in technical sphere. It provides many opportunities and development of mental, cognitive and creative qualities of future specialists, the level of which determines their competitiveness in the modern labor market: an ability and readiness to solve complex tasks (problems), critical thinking, creativity, cognitive flexibility, cooperation, management, implementation of innovative activities, ability to act effectively in conditions of uncertainty, etc. STEM, as a process of external influence on an individual, is aimed at personal (acquiring authentic practical experience of innovative activity, knowledge management, learning, ecological thinking, emotional intelligence, introspection and reflection) and social (communication, mentoring and monitoring, teamwork, nonviolent communication) aspects. In this regard, the authors also paid attention to the formation of soft skills - developed personal qualities that help to perform work effectively and successfully, build future career and be in demand and stay ompetitive in the modern labor market. Through the conducted research, the authors of the article emphasized that the introduction of STEM technologies into the educational process of technical specialists is aimed at training specialists with a new type of thinking, without which the development of innovative economy and formation of scientific and technical elite of Ukraine are not possible.

Keywords: STEM-approach, STEM-technologies, hard skills, soft skills, technical sphere specialists, personal and social aspects, professional competence, competitiveness.

Мовмига Наталія Євгенівна кандидат психологічних наук, доцент кафедри безпеки праці та навколишнього середовища, Національний технічний університет «Харківський політехнічний інститут», вул. Кирпичова 2, м. Харків, 61002, тел.: (095) 393-06-39, <https://orcid.org/0000-0002-7207-8558>

Полежаєва Олена Вікторівна старший викладач кафедри педагогіки, іноземної філології та перекладу, Харківський національний економічний університет ім. С. Кузнеця, пр. Науки 9а, м. Харків, 61165, тел.: (067) 771-81-42, <https://orcid.org/0000-0002-3178-6339>

Гуренко Ірина Вікторівна кандидат технічних наук, доцент кафедри безпеки праці та навколишнього середовища, Національний технічний університет «Харківський політехнічний інститут», вул. Кирпичова 2, м. Харків, 61002, тел.: (099) 027-09-02, <https://orcid.org/0000-0001-6074-937X>



ВИКОРИСТАННЯ STEM-ТЕХНОЛОГІЙ В ОСВІТНЬОМУ ПРОЦЕСІ ПРИ ПІДГОТОВЦІ ФАХІВЦІВ ТЕХНІЧНОГО ПРОФІЛЮ

Анотація. В даній статті розглядається актуальність та необхідність впровадження інноваційного підходу в сучасній освіті - STEM-підходу, орієнтованого на формування у здобувачів освіти навичок науково-дослідницької й інженерної діяльності, винахідництва, підприємництва, професійної самовизначеності. На сьогодні вища освіта повинна забезпечувати підготовку фахівців із сформованими якостями, які відображають їх ціннісну орієнтацію, професійну компетентність, соціальну спрямованість і можливість задовольняти особисті й суспільні потреби, осіб із професійним рівнем, який відповідав би сучасним міжнародним вимогам та стандартам. Авторами проаналізовано суттєві характеристики STEM-підходу як нового та інноваційного механізму трансформації сучасної вищої освіти через науку; визначено необхідність впровадження STEM-технологій в освітній процес фахівців технічного профілю, виявлено переваги їх застосування, визначено етапи професійної освіти фахівців технічного профілю за допомогою STEM-технологій. В статті окреслено необхідність цього застосування в ракурсі розглянутої проблеми, та визначено, що STEM-освіта за допомогою практико-орієнтованих методик відкриває фахівцям технічного профілю шляхи розвинення та застосування науково-технічних знань у професійному зростанні, надає безліч можливостей та розвитку розумово-пізнавальних і творчих якостей майбутнього фахівця, рівень яких визначає конкурентну спроможність на сучасному ринку праці: здатність і готовність до розв'язання комплексних задач (проблем), критичного мислення, творчості, когнітивної гнучкості, співпраці, управління, здійснення інноваційної діяльності, здатності ефективно діяти в умовах невизначеності та ін. STEM, як процес зовнішнього впливу на індивіда, також має на меті особистісний (здобуття автентичного практичного досвіду інноваційної діяльності, управління знаннями, навченість, екологічність мислення, емоційний інтелект, самоаналіз та рефлексія) та соціальний (комунікація, наставництво та моніторинг, робота в команді, ненасильницьке спілкування) аспекти. З цього приводу, авторами також приділено увагу формуванню Soft skills - розвиненим особистісним якостям, які допомагають результативно виконувати роботу та успішно будувати майбутню кар'єру, та бути затребуваними та конкурентоспроможними на сучасному ринку праці. Проведеним

дослідженням, автори статті підкреслюють, що впровадження STEM-технологій в освітній процес фахівців технічного профілю, спрямоване на підготовку фахівців з новим типом мислення, без яких неможливий розвиток інноваційної економіки та формування науково-технічної еліти України.

Ключові слова: STEM-підхід, STEM-технології, Hard skills, Soft skills, фахівці технічного профілю, особистісний та соціальний аспекти, професійна компетентність, конкурентоспроможність.

Problem statement. The modern system of higher education has become "multifunctional" in nature in recent years. This principle is based on the training of "unified personnel", when the educational program captures the basics of related professions to perform a wider range of tasks. One of the successful types and methods of educational activities is the STEM approach. The main orientation of the new method is to contribute to the formation of students' skills in scientific research and engineering, invention, entrepreneurship and professional self-determination. A specialist of the 21st century must be able to freely express innovative and creative ideas, cooperate with representatives of various fields of activity, understand the mechanisms of interaction between natural sciences and art, mathematics and humanitarian sciences and technologies, be aware of their application areas, be capable of creativity and ingenuity.

Currently, the trend of the STEM approach is being actively implemented in pedagogical science - one of the breakthrough tools for the transformation of modern higher education through science. The STEM approach is aimed at the development of an individual through the formation of competences, worldview positions and life values using a transdisciplinary approach to education based on the practical application of scientific, mathematical, technical and engineering knowledge and skills to solve practical problems for their further use in professional activities. Students learn to harmoniously combine scientific accuracy and creative freedom in their activities [1].

STEAM (English: S - natural sciences; T - technologies; E - engineering, projecting, design; A - arts, humanities and social sciences; M - mathematics) is an innovative approach to learning, which is the highest level of STEM development, supplementing it by involving in the solution of practical issues of humanitarian, creative, artistic and other disciplines, successfully combines creativity and technical knowledge.

In the modern conditions of the development of market economy and social relations, the requirements for personal and professional qualities of



higher education institutions graduates are increasing. These requirements are designed to contribute to the formation of specialists' competitiveness for their successful employment, professional activity and further career growth. Under these conditions, higher education should ensure the training of specialists with the developed qualities that reflect their value orientation, professional competence, social orientation and the ability to satisfy personal and social needs, i.e. persons with a professional level that would meet modern international requirements and standards.

The uniqueness of each individual enterprise requires a new employee with special skills in relation to practical activities. But despite this, upon employment, a specialist with a higher education should demonstrate to the employers his professional skills and ability to work effectively.

Today, employers' requirements for future specialists are also changing. Employers set certain requirements for potential employees, the main of which are:

- be ready to constantly learn new things: self-learning, knowledge of languages, cross-functionality;
- be aware of technologies and information systems: technological literacy, innovative technologies;
- be able to act in a situation of uncertainty: creativity, initiative, the ability to cooperate with other people;
- be able to quickly "react", the ability to think for the future;
- cope with the growing complexity of the world: stress resistance, maintaining mental and physical health;
- freely navigate in large flows of information: be able to separate the main from the particular, the necessary from the unnecessary, analytical skills;
- think rationally, holistically and systematically: design thinking, project thinking, systems thinking;
- possess an emotional intellect.

In addition, among the new vacancies requirements, employers began to note: flexibility, mobility, discipline, fairness, optimism and adaptability. Communication, friendliness, politeness and decency are also indicated.

Analysis of recent research and publications. For the first time, a new teaching methodology was discussed at the beginning of the 20th century in the United States. To date, it has been successfully used in vocational education in leading and developing countries, in higher education training of mainly technical or other "applied" specialists. Today, STEM is one of the main trends in educational policy in most developed countries of

the world. Many countries, such as Australia, China, Great Britain, Israel, Korea, Singapore and the United States have governmental programs in the field of STEM education. This direction in education makes it possible to strengthen the scientific and natural component in educational institutions.

Currently in Ukraine systematic research in the field of STEM education is being conducted; scientific, educational and methodical literature for participants of the educational process is developed and published; STEM centers for joint work of teachers, students, university professors and scientists are created; public research laboratories are opened, makers` festivals are held and STEM communities are formed; the expert community in the field of STEM education is being established; the qualification of scientific and pedagogical workers in STEM education is being improved, taking into account the best national and international practices. Many Ukrainian scientists will highlight the introduction of STEM technologies in various fields and subject studies. Scientists of DNU "IMZO" defined a conceptual and categorical apparatus for the problem of researching the main aspects of STEM education, created a glossary of STEM education terms and an annotated catalog of STEM education. Methodical recommendations for the implementation of STEM education in educational institutions are developed and published annually. The key ideas and concepts of STEM education proposed by scientists are taken into account in the Concept of Development of Science and Mathematics Education (STEM Education). A number of studies have been carried out: "Readiness of educational institutions for innovative activities"; "Study of the state of equal access of student youth to choosing and obtaining STEM professions"; "The state of development of STEM education in Ukraine"; "Effectiveness of educational processes in the conditions of modernization of the educational sector. State of development of STEM centers/laboratories in Ukraine" and others [1-3].

Many Ukrainian scientists su Baka O.M., Bashtannyk A.G., Bovda E.M., Bondarenko K.V., Boychenko V.V., Gilyaka O.S., Gumenyuk T.I., Dembytska S.V., Kuzmenko O.S., Karatnyk I.V., Mernyk A.M., Lozova S., Nechiporuk V.M., Savchenko I.M., Stryzhak O.E., Patrikeeva O., Pohorletska N.V., Chernyshenko G.O., Chernyuk T.I. and many others have already highlighted the topical issues of the use of STEM education and its regulatory legal support in Ukraine, the advantages and mechanisms of implementing STEM technologies in their varieties in educational process when training specialists of various profiles.

The **purpose** of this article is to clarify the current issues of innovative STEM technologies in educational process, to study the advantages of



introducing STEM technologies into the educational process when training technical specialists, and to determine the quality of training of future technical specialists with modern skills in demand on the labor market, which reflect the future professional competence, personal and social orientation, that is, specialists with a professional level that meets modern international requirements and standards.

Presenting main material. According to the law of Ukraine on "Higher Education", one of the main directions of updating the content of higher education is to ensure its quality based on the latest achievements of science, culture and social practice. According to this law, it is specified that the educational branch of "technology" performs the functions of providing technical and technological education, relying on the laws and regularities of the development of a man, nature, society, culture and production [4].

The state scientific institution "Institute for the Modernization of the Content of Education" determines that the strengthening of the role of STEM education is one of the priorities of the modernization of education, an integral part of the state policy on increasing the level of competitiveness of the national economy and the development of human capital as one of the main factors of innovative activity in the field of education that meets the demands of economy and the needs of society. STEM education is aimed at the development of an individual through the formation of competencies, natural and scientific picture of the world, worldview positions and life values using a transdisciplinary approach to learning based on the practical application of scientific, mathematical, technical and engineering knowledge and skills to solve practical problems for their further use in professional activities [1].

In addition, implementing the development of STEM education in educational institutions defines the higher/professional level as the training of specialists in various scientific and technical, engineering professions on the basis of higher education institutions, as well as the improvement of professional skills of pedagogical workers in the implementation of new teaching methods, relevant courses and implementation of innovative projects.

The purpose of STEM education is to prepare a person of the future - a creative and free individual who is able to learn throughout life, think critically, find non-standard creative solutions, adapt to modern conditions of social mobility; is capable of mastering advanced information technologies, to achieve success in conditions of rapid technological development of global society [2].

As a part of STEAM, certain thematic modules are distinguished:



– Natural sciences, designed to explain the effect of specific facts, theories, rules of nature, affecting all aspects of human life: from everyday life to professional experience and professional activity;

– Technology, which involves the development of scientific activity and creative abilities during the search for a solution, the answer to a research question, the application of previously acquired knowledge in practice;

– Engineering. This block is designed to connect modern tools and methods, modern technologies to the training system, improve, increase the effectiveness of actions and decisions, optimize the situation, taking into account the opportunities;

– A mathematical block is focused on the development of accuracy, concentration, attentiveness, the development of critical thinking, an analytical mindset, skills for the clear application of instructions and algorithms;

– Humanitarian (artistic) block, designed not only to expand the horizons and deepen the understanding of ongoing processes, but to develop creativity, professional culture and business communication, learn to prove one's own point of view, conduct a constructive and reasoned dialogue.

It should be noted, if the general understanding of the components of the professional culture of a future specialist presupposes the presence of a professional culture, a culture of business communication and specific knowledge, abilities and skills that correspond to the acquired profession in its structure, then in modern conditions an important component of it is the implementation of organizational and managerial functions. Recently, the socio-technical factor has gained a special importance in the formation of safety culture, in which the main attention is paid not only to the technical components of a profession, but also to the human factor, that is, the content and nature of human activity, its valuable, social and psychological aspects [5].

All blocks are studied simultaneously and in one bundle, including logic thinking and tracing relationships (one problem can be studied from different angles, positions, sciences and theories).

It is important to understand that STEAM is not just a technical education. It encompasses a much broader concept, namely a successful combination of creativity and technical knowledge. Thus, the student will be able to apply his knowledge to solve poorly structured technological problems, develop technical abilities and more intensively master the skills of highly organized thinking. Studying in the main directions allows you to form the most important characteristics that determine the competence of a



specialist: an ability to identify a problem; an ability to see relationships between phenomena; an ability to formulate a research question and the sequence of its solution; originality and creative approach; an ability to abstract and analytical thinking; an ability to concretize and synthesize.

It is worth noting that STEM education is a competency-based innovative model of education that defines the appropriate pedagogical process (technology) for the formation and development of mental, cognitive and creative qualities of young people, the level of which determines their competitiveness in the modern labor market: an ability and readiness to solve complex problems (tasks), critical thinking, creativity, cognitive flexibility, cooperation, management, implementation of innovative activities. When it is applied, the main qualities of a successful professional are synthesized. These are the following: competence, creativity, innovation, communication, unification and individuality at the same time.

Let us consider the main features of an innovative educational mechanism:

- a combination of difficult to combine features such as an accuracy, logic, creativity. The new principle is designed to give an explanation to any phenomenon from different points of view, having received a comprehensive explanation, establishing the root cause. STEM teaches to consider the problem as a whole but neither from a narrow perspective nor in the context of a specific science or theory.

- the educational process is based on project activities. Project work involves the application of theoretical knowledge and ideas in practice, theoretical coverage of the problem and its practical inspection (during an internship, etc.). Teamwork is welcome: a student is a supervisor, a group of students, etc. This option allows you to gain practical experience that is close to labor realities;

- project technology assumes the presence of integrated knowledge and a search for its solution. The teacher should be aware of research methods: be able to organize and conduct discussions without "suppressing" the initiative of students by his authority, that is, be able to manage projects and project activities [6];

- a comprehensive justification of the proposed solution and the inclusion of innovations, modern methods and devices, optimization of processes based on the achievements of scientific and technical progress;

- minimization of fear of innovations and experiments, development of curiosity, experimentation based on scientific thoughts, facts and rules.



Thus, the STEM approach is based on the possibility of interdisciplinary (adjacency) and non-traditional application of acquired knowledge in any sphere and any conditions to achieve the best result.

Professional training of technical specialists at the current stage requires the use of the latest scientific achievements, technological and methodological innovations in educational and methodological work. With regard to our research, STEM, with the help of practice-oriented methods, opens up the ways for technical specialists to develop and apply scientific and technical knowledge in their professional growth. The development of scientific and practical orientation related to engineering and technologies brings to the fore the identification of personal, cognitive, regulatory, motivational and other factors that will lead to the effective performance of scientific research and professional tasks. During the training, the development of engineering thinking is important for specialists of this sphere. It can be ensured by the introduction of STEM technologies in the conditions of the above-mentioned informational and educational environment.

Based on the foregoing, the following stages of professional education of technical specialists using STEM technologies can be distinguished:

- Immersion in theoretical subjects: study of terms and definitions, rules, facts, patterns, old and new concepts, etc. At this stage, the student is "instructed";
- Completion of cases and practical tasks. This stage is designed to adapt the acquired knowledge and theories into applied art: explain, decide, analyze what actions to take and how to justify them, predict results, etc.
- Practical orientation: involving students in "project" or scientific activities with experiments, observations, participation in a particular process with further description, analysis and optimization. This stage is focused on the development of professional qualities in a particular industry, especially for the graduates of technical specialties;
 - Analysis of current topics and problems from the origins to the current state within the disciplines or spheres of interest;
 - Scientific activity. At this stage, students are attracted to science, discoveries, development, the use of innovations, making new breakthroughs, motivated by prospects: the possibility of promising employment, career or income growth, etc.
 - Practice, internship. Students undergo three types of practice in all specializations. Combining work on a graduation project with internship, students can not only gain experience that is as close as possible to their future profession, but also develop and improve teamwork skills.



When entering the labor market, specialists with higher education, in addition to theoretical knowledge, must possess the skills and abilities of practical activity in the relevant field. Modern specialists of a technical profile are expected to be prepared to perform professional duties at a high level, to make effective managerial decisions, to be competent in the implementation of innovative ideas, to act productively in situations with some uncertainty, and therefore it is necessary to have some technical experience and possess knowledge and skills in the field of information technologies. In addition, there is a need to realize creative abilities and develop organizational and communication skills.

Thus, we can state that the nature of STEAM in the educational process of technical specialists provides opportunities for:

- reduction of the distance between the theoretical knowledge that is acquired in the process of training and education, and the skills and abilities when applying this knowledge in practice in reality;
- promotion of the development of intellectual abilities;
- teaching how to search and process information with its subsequent practical and creative application;
- helping students apply higher-order thinking skills to solve complex problems;
- development of logical and mathematical thinking;
- providing students with the opportunity to develop and implement new ideas and achievements;
- promotion of innovation, provision of content knowledge and hands-on learning opportunities;
- development and implementation of projects using mathematics, natural science knowledge and information technology tools;
- creation of projects that are of a real practical nature and implemented according to the stages of a complete engineering design process;
- development of social creativity, i.e. the ability of a person to quickly find and effectively apply non-standard, original, creative solutions concerning professional and interpersonal interaction; possession of methods of argumentation and business communication;
- development of the ability to find a way out in a state of uncertainty and ambiguity;
- creation of strong links between training and the specialization acquired, which will contribute to the improvement of the future specialist and increase his competitiveness;

- stimulation of creative imagination and provision of an opportunity to explore the unlimited potential of possibilities. Engaging in technical creativity (and subsequent passion for it) can be an important step towards professionalism;
- development of curiosity, self-learning and self-discipline, motivation to develop new opportunities and professional achievements;
- the ability to find non-standard solutions to a variety of issues, thereby strengthening self-confidence;
- adaptability, the ability to work in critical conditions, stress resistance;
- shifting the focus of perception from thinking to creative thinking, which collectively contributes not only to the increase of student's spirituality, but also to the development of creative abilities;
- development of cultural outlook, a culture of professional and business communication is being formed;
- development and improvement of soft skills.

Today, in the professional environment, it is essential to distinguish 2 types of skills: hard skills and soft skills which are relevant to modern specialists.

In the 21st century, the contribution of hard skills to the professional success of an employee is only 15%, while soft skills determine the remaining 85%. These are the results of the study by Harvard University and the Stanford Research Institute [7].

Let's consider these concepts in detail.

Hard skills are any skills related to a specific task or situation, including understanding and knowledge of a specific activity [8].

Scientists define them as a system of professional competencies that combine special, professional and general didactic knowledge, professional skills, professional abilities and professionally important personality traits. They reflect the professional level of a specialist, which can be clearly demonstrated. But they are characterized as such that are easy to measure, giving them an objective assessment. Hard skills include professional knowledge, as well as skills and abilities that are necessary for the performance of professional tasks [8,10,12].

Hard skills are narrow professional skills that are needed to solve specific professional problems. Hard skills are formed in the learning process and based on technical knowledge.

Soft skills (English soft skills) are a set of non-specialized, super-professional skills that are responsible for successful participation in working



process, high productivity and, unlike specialized skills, are not related to a specific field [9].

Soft skills are characterized based on the definition: "Soft" means "flexibility", lack of stereotypes, patterns, overcoming fixed functionality, ability to change. "Skill" is a "competence", readiness and ability of an individual to act in changing situations, relying on intuition and own experience. This is a set of non-specialized supra-professional "flexible competencies" that affect the successful performance of professional duties by specialists in any field of activity and determine the professional self-realization of specialists. Assessment of soft skills is subjective [10-13].

Soft skills are not specific to specific professions. These are personal qualities that help to perform work effectively and successfully build a future career; super-professional skills that help to interact with people, in a team, regardless of the field of activity.

Researchers and employers unanimously affirm the need for the formation and development of soft skills of higher education graduates as an inseparable component of their professional training and a guarantee of successful employment and career growth. That is why, in our opinion, the issue of the formation of soft skills of higher education students should be of primary importance among the main issues of organizing the educational process of any modern institution of higher education [14].

Experts note that since the declaration of martial law, the number of employers who specify desired soft skills in their job descriptions has increased.

Soft and hard skills should supplement each other in order to solve problems of varying complexity.

STEM as a process of external influence on an individual, has both personal (gaining authentic practical experience of innovative activity, knowledge management, learning, ecological thinking, emotional intelligence, introspection and reflection) and social (communication, mentoring and monitoring, team-working, non-violent communication) aspects.

Let's take a closer look at the most important ones from our point of view.

With the help of *communication*, people get into contact with each other, life and professional tasks are fulfilled. The communication block includes two important skills: professional (business) communication (the ability to correspond, negotiate with colleagues and managers in order to solve problems and achieve goals) and presentation and oratory (the ability to clearly and accurately convey one's thoughts and ideas).

Critical thinking is one of the key skills of the 21st century, which allows us to analyze information, draw conclusions and make decisions based on the analysis, as well as form our own opinions and defend our points of view. Critical thinking helps to see cause-and-effect relations, generalize and structure information, argue one's opinion and see weaknesses in the opinions of others. Today, specialists in any field, in particular technical specialists, must be able not only to perform routine actions well, but also to make non-standard decisions, find new ways and approaches to problems solving. Critical thinking helps to evaluate the tasks from different angles and helps to avoid errors associated with an inaccurate or insufficient information.

Emotional intelligence (EQ) is the ability to recognize and manage your own and others' emotions. EQ is personal and social skills. They help to solve practical problems, make decisions and build communication with other people.

Nonviolent communication (NVC) is communication of empathy or cooperation. NNS helps to be in contact with people, to build partnerships in the most difficult work and life situations, to see the world as a space of opportunities.

Knowledge management skill is the ability of a person to receive, systematize and critically process new information, while applying the acquired knowledge in practice in order to increase both professional and personal effectiveness and achieve the goals.

Learning is the ability to master new theoretical and practical material, analyze and systematize it. It is important enough to learn how to apply it into practice, turning it into full-fledged competencies. Knowledge management helps you select the right sources of information, sort it, and manage your learning plan. Learning new things means constantly training your thinking, memory, logic, imagination, and analytic skills.

Work in a mode of high uncertainty and rapid changes in task conditions is the ability to make quick decisions, respond to changing working conditions, the ability to allocate resources and manage your time. It is important to be able to manage your resources - how to achieve a high concentration on a task and enter a state of relaxation in stressful situations. Flexibility and readiness for constant changes will be essential.

Lean manufacturing is the ability to eliminate waste of any kind, find bottlenecks and improve the process of creation. This skill helps to save the resources of a particular person or an entire staff of employees. Properly calculated personal workload prevents professional burnout.

Ecological thinking implies the responsibility for one's actions and a positive attitude towards the world, dedication to one's work, getting satisfaction from the result of one's activity.



Self-reflection is a person's reflection in various situations through his consciousness. Self-reflection teaches: to understand people; opens up opportunities to better understanding of others, their goals, behavior, actions; makes it possible to analyze personal experience; helps to find the strengths and shortcomings of the personality; teaches to develop thinking; allows to overestimate personal values, judgments; provides an opportunity to rethink one's attitude in relation to events, change tasks and goals; improves intuition; develops the ability to take thoughtful and rational decisions.

Thus, the development of soft skills in future technical specialists is one of the components of their professional competences and the effectiveness of their professional activities. The creative economy requires a new approach to the selection of personnel where the most essential quality is the uniqueness of a person that will allow him to express himself most effectively for the sake of his well-being, the team and society as a whole.

The expediency of soft skills development is determined by social demand and objective societal need of specialists who possess developed "soft skills". At the level of institutions of higher education institutions, it is advisable to implement policies and procedures for the end-to-end formation of soft skills [15].

We can say that this integrated approach stimulates the interest of students of technical specialties in science, technical art and design, creative engineering, mathematical modeling, as it develops a number of important professional skills and qualities.

Conclusions. We can state with a confidence that such an innovative approach in the system of modern education contributes to the formation of scientific and technical elite of Ukraine.

The introduction of the STEM education system is caused by the new world economy. It includes the involvement of young professionals in scientific-intensive industries: neuroelectronics, robotics, bioelectronic medicine, neurobiology, mathematics, engineering, etc. The solution of this promising task will improve the qualitative characteristics and efficiency of the use of human capital. Today, there is a need for experienced and competent specialists, and therefore there is an educational need for their qualitative training. The level of education must correspond to the trends in the development of technology and industrial production in the future. This requires updating the methods and forms of academic disciplines teaching, finding the effective methods, and using the latest pedagogical technologies. Thus, summarizing the above, we can say that the introduction of the STEM approach into the educational process of technical specialists opens up the new horizons for professional education and is an algorithm for the formation

of the most important competencies of a future specialist. The main skills that future specialists acquire are: understanding of professional and ethical responsibility for making engineering decisions; an ability to critically react on the decisions made; intellectual curiosity, human resource management and self-organization skills; an ability to assume leadership positions in a team; understanding the importance of lifelong learning; mastery of argumentation techniques and professional communication; an ability to work in a multidisciplinary team, social responsibility.

The introduction of STEM technologies in the educational process is aimed at training specialists with a new type of thinking, without which it is impossible to develop an innovative economy and form the scientific and technical elite of Ukraine.

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