

CREATIVITY OF FUTURE ENGINEERS

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Performing any professional activity clearly requires a specialist to possess a certain combination of abilities, knowledge, skills, and competencies. The composition of these competencies varies depending on the characteristics and complexity of the work. Engineering activity, by its nature, involves solving production, technological, design, and other tasks, each of which requires a creative approach and the application of creative and productive abilities, since it entails developing a new product, software, production model, etc. In other words, for an engineering professional to achieve professional success and personal professionalism, they must have developed an attribute of thinking and personality—creativity – that ensures a non-standard approach to solving professional problems and resourcefulness in professional matters.

A creative approach to any activity has become a social necessity for society and is a decisive condition for its efficiency and progress. A future engineer must be ready to independently set and solve complex professional problems. Today, an engineer must not only possess professional competence and a high level of general culture but also approach different situations unconventionally and organize their activities on a creative basis.

In contemporary psychological and pedagogical literature, the following definition of the term “creativity” is accepted: “Creativity (from English create – to create) is an individual’s creative abilities, characterized by readiness to generate fundamentally new ideas that deviate from traditional or accepted patterns of thinking and are part of giftedness as an independent factor, as well as the ability to solve problems that arise within static systems.”

Modern science identifies the following criteria for creativity: speed (the number of ideas generated per unit of time); originality (the ability to produce unusual ideas, different from generally accepted ones); flexibility (this parameter allows distinguishing individuals who demonstrate flexibility in problem-solving from those who exhibit rigidity, and also distinguishes individuals who solve problems originally from those who demonstrate false originality); sensitivity (awareness of unusual details, contradictions, and uncertainty, readiness to quickly switch from one idea to another); metaphorical thinking (readiness to work in an entirely unusual context, tendency toward symbolic and associative thinking, the ability to see the complex in the simple and the simple in the complex); and satisfaction (the result of creativity. If the result is negative, the motivation for further development is lost).

Alongside intellectual creativity, social and professional creativity exist. Professional creativity is a certain psychological and psychosocial readiness of a person to change situations in their professional field, which increases the effectiveness of interaction between the engineer and colleagues in joint activities.

Indicators of professional creativity include creative well-being (self-regulation and self-control, emotional stability, volitional qualities, sense of joy, level of productivity, love and kindness toward people) and creative abilities (resourcefulness, combinatorial ability, divergent thinking, visual creativity, associative thinking). The term “creativity” refers to an individual’s ability to creatively comprehend life events and personal experience, to creatively use and transform the known, and to create qualitatively new outcomes.

An engineer’s creativity is reflected in their professional activity, which is commonly characterized as professional creativity. The formation and development of an engineer’s creative potential is facilitated by the implementation of the following interrelated psychological and pedagogical conditions:

- stimulating activity, independence, and internal freedom;

- the use of reflection in the process of personal and professional development;
- designing and organizing the educational process based on personal and professional values defined by humanistic and creative paradigms;
- extensive use of a creative approach in educational practice;
- filling the educational and developmental environment of a future engineer with creativity.

What does the concept of “creativity” include in relation to an engineer’s activity? In our view, it encompasses the ability to think creatively, find original solutions to problems ahead of time, solve creative tasks, manage psychological inertia in thinking, make decisions under risk conditions, and understand the basic patterns of the surrounding world, systems, and objects.

The importance of developing an engineer’s creativity is determined by several aspects:

- social, as it forms a new type of person with a special type of thinking capable of radical changes and transformations;
- scientific, as it serves as a means of understanding creative abilities in the fields of intellectual and social creativity;
- practical, as it allows the application of new technologies for the direct development of creativity.

The requirements society and individuals impose on educational outcomes have necessitated radical changes both in the content of education and in pedagogical technologies. These requirements and goals are implemented through a creative approach, which in education involves a system of continuous development of creative thinking and abilities in students. The main goal of the educational system is to awaken the creator within a person and develop their inherent creative potential.

Creativity is especially important in an engineer’s professional activity. The prominent American psychologist Abraham Maslow approaches this problem as follows: “How should one begin teaching, for example, engineers? The answer is

obvious: we must teach people to be creative, in the sense that they are ready to accept new things and can improvise. ... They should not fear change, should be able to remain calm in the rapid flow of the new, and, ideally, welcome everything new. This means we must educate and prepare not simply engineers, not engineers in the old, conventional sense, but creative engineers.”

An important pedagogical requirement for a creative educational process is continuity, succession, and the inclusion of future engineers in an active educational environment and in the independent management of the creative process. The accumulated human experience becomes almost meaningless in some areas of life. People overly attached to the past have become almost redundant in many professions. It is the time of the new person, capable of detaching from their past, feeling the power, courage, and confidence to trust the demands of the situation, and able, if necessary, to solve emerging problems through improvisation, without prior preparation.

A creative educational process allows each student at every educational level not only to develop their initial creative potential but also to form a need for ongoing self-knowledge, creative self-development, and an objective self-assessment. Modern education should aim at mastering emotionally valuable experiences, ensuring relative adaptability of the individual to social and natural environments, and promoting self-realization and the unfolding of the individual’s spiritual potential. Addressing this challenge involves moving away from transmitting ready-made knowledge and value-normative concepts through reproductive pedagogy and developing new psychological and pedagogical technologies for the development of future engineers’ personalities.

A creative, integrally-thinking engineer is a professional capable of processing knowledge as an objectively manifested product of creativity, transmitting knowledge through all types of perception and information processing, and enriching the activity environment (as opposed to an informational network) with two life-sustaining flows: information and humanistic energy.

Today, creativity largely serves as a mechanism for an engineer's adaptation to social changes. To be internally aligned with modern reality, an engineer must not only adapt to new situations but also be able to change them, while developing and evolving themselves. Flexibility and originality of thought can be seen as survival factors in contemporary society and as essential qualities for solving life-critical problems, particularly in assessing one's place in real life. The instability and lack of guarantees of contemporary social values require individuals to form their own assessment of ongoing events. Developing creativity and the creative individuality of a future engineer contributes to enhancing their competence and professionalism.

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**MODERN APPROACH TO THE IMPLEMENTATION OF ARTIFICIAL
INTELLIGENCE INTO THE EDUCATIONAL PROCESS OF
UNIVERSITIES AND ITS CONSEQUENCES**

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Introduction. The integration of Artificial Intelligence (AI), particularly Generative AI (GenAI), is no longer a future consideration but an immediate and