FUTURE ENGINEERS' PERCEPTION OF BASIC PROFESSIONAL COMPETENCE AND THEIR ABILITY TO INNOVATIVE THINKING

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Summary: Martial law in Ukraine contributes to rethinking and changing directions of work in the economy and in education. New innovative approaches and specialists are needed to rebuild the country's infrastructure, who are able to think innovatively and creatively. Determination of features of future engineers' perception of basic professional competence and their ability to innovative thinking was carried out using a survey among undergraduate engineering majors of the first year of study of the Kharkiv National University of Urban Economy named after O. M. Beketova. Taking into account the results of the survey, during the martial law, the age structure of those seeking education changed: the number of older students increased; it is also observed that future engineers underestimate such an important professional quality as the ability to apply knowledge from technical disciplines; higher education applicants do not consider the ability to self-study important. As a result, this important personal quality is regarded as one that has almost no influence on the development of innovative thinking. The study points to the need to improve and develop the technical training of future specialists, their ability to self-study and creative thinking.
Key words: future engineers, basic professional competence, innovation, innovative thinking.

Formulation of the problem. The conditions of martial law dictate new approaches in the functioning of the state, and therefore it affects the economy, industry, education and all other spheres of life. During the massive attacks of the aggressor country, specialists of various fields have to apply all their professional competences and abilities to find new innovative solutions for the elimination of various types of accidents, damages, adjustments of new equipment or improvement of the old one. All this is possible only if specialists have a high level of professional competence, which affects the ability to find new ways to solve problems. This means that future engineers even now, during their studying at universities, should understand that the formation of their basic professional competence and the ability to think innovatively are necessary for their future successful professional activity.

Analysis of research and publications. In the dictionary, the term "innovative" is interpreted as something related to innovation. Therefore, it is directly related to the definition of "innovation", which is defined as "(English innovation, from the Latin innovatio – renewal, change) an innovation in the field of economy, technology, etc. based on the achievements of science and best experience" [6, with. 247]. In the Law of Ukraine "On Innovative Activities" in Chapter I of Article 1, the term "innovations" is defined as "newly created (applied) and (or) improved competitive technologies, products or services, as well as organizational and technical

solutions of production, administrative, commercial or other of a nature that significantly improves the structure and quality of production and (or) the social sphere" [2].

The work of T. Seredyuk [5] is devoted to the study of innovations in the field of ICT, innovations in linguistics are examined by scientists Yu. Stefanyshyn [7] and M. Glukhovskaya [1], the study of the impact of innovative thinking on the future professional is devoted to the work of S. Strilets [8], researcher L. Shumelchyk considers innovative thinking as an important component of professional training in engineering education [9]. Therefore, the topic of innovations and innovative thinking, their impact on various spheres of life is relevant and arouses great interest among scientists. However, research on the ability of future engineers to think innovatively and their perception of basic professional competence is not enough.

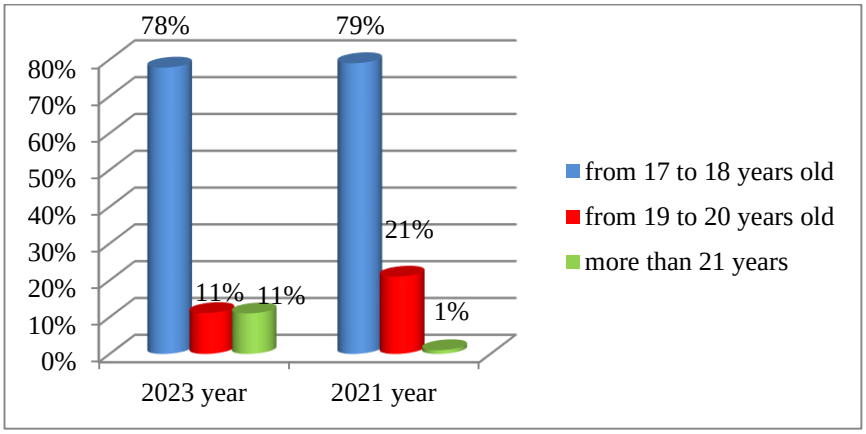
Reviewing the Law of Ukraine "On the Priority Directions of Innovation Activity in Ukraine", Article 4 "Strategic Priority Directions of Innovative Activity for 2011-2023", we can conclude that the important strategic areas of innovative activity in our country are the development and introduction of new technologies in various fields, such as: energy transportation, transportation system, rocket and space industry, aircraft and shipbuilding, weapons and military equipment, materials science, nanotechnology, agro-industrial complex, medical industry, environmental protection and information technology [3]. None of the listed industries can work without highly qualified engineers of various specialties, such as: power engineer, transport engineer, design engineer, design engineer, etc. We absolutely agree with this information and to confirm this we want to use the words of researcher S. Reznik "modern business is characterized by a wide range of activities, frequent transition to new products, which requires the innovative thinking of an engineer, the ability to find effective solutions in non-standard situations" [4, p. 18].

The purpose of this article. To research the perception of future engineers of basic professional competence and the ability to think innovatively.

Main part of research. To conduct a study of future engineers' perception of basic professional competence and the ability to think innovatively we used a questionnaire of future engineers during the study of mathematical disciplines that affect the ability of future engineers to think innovatively.

During the research, we conducted a survey of 36 first-year students of the Kharkiv National University of Urban Economy named after O. M. Beketov in the following specialties: 192 "Construction and civil engineering" (15 students), 185 "Oil and gas engineering and technologies" (14 students), 126 "Information systems and technologies" (7 students). The survey consisted of 5 questions.

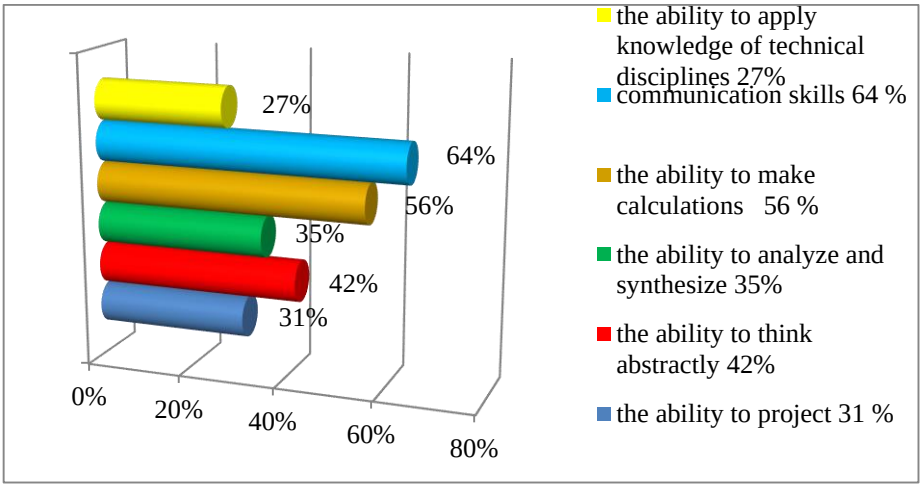
The first question was related to the age of the respondents. Data analysis (picture 1) indicates changes in the age range of education seekers compared to pre-war times, namely, the number of future engineers who are older than the 21st year has increased by approximately 10%. The main reason is that with the beginning of the war, some specialties lost their relevance. On the other hand, engineering has gained more importance, and at the same time, the demand for them is precisely among those who receive a second higher education.



Picture 1 – Changes in the age range of education seekers

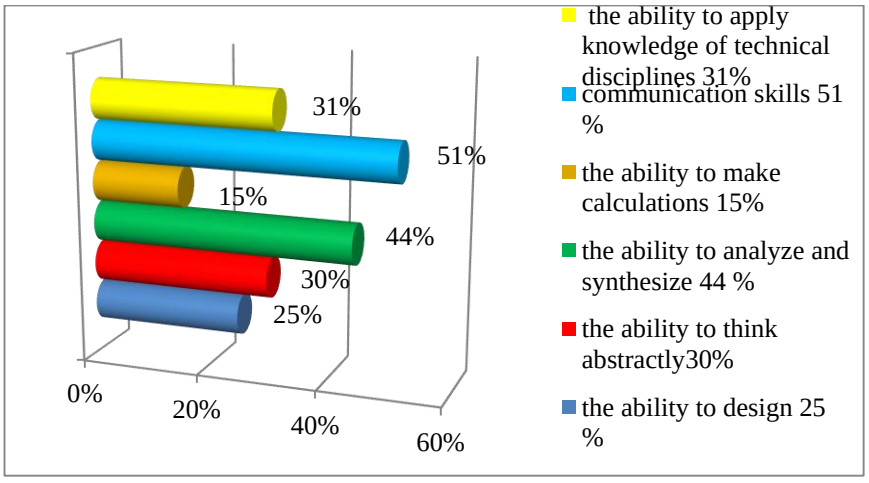
With the help of the second question: “In your opinion, what professional qualities of a specialist do future engineers need?” the students' perception of their future professional qualities was clarified. Six of the most frequently mentioned professional qualities of future engineers were identified among the answers provided (Picture 2).

Based on the obtained data, it can be concluded that the most important professional qualities of future engineers are: communication skills (64%), the ability to make calculations (56%) and the ability to think abstractly (42%), but the ability to apply knowledge from technical disciplines only 27% of respondents consider the professional qualities of future engineers to be necessary. This indicates that a significant number of surveyed first-year students are not aware of the importance of the ability to apply knowledge from technical disciplines, and this will directly affect the formation of their basic professional competence.



Picture 2 – Perception by students of education of their future professional qualities

We are going to analyze the answers to the third question: "Which of the professional qualities of a specialist you listed earlier influence the development of innovative thinking of a future engineer?" (Picture 3). It was found that students consider their communication skills (51%) and the ability to analyze and synthesize (44%) to be the most important professional qualities of a specialist that influence the innovative thinking of future engineers.

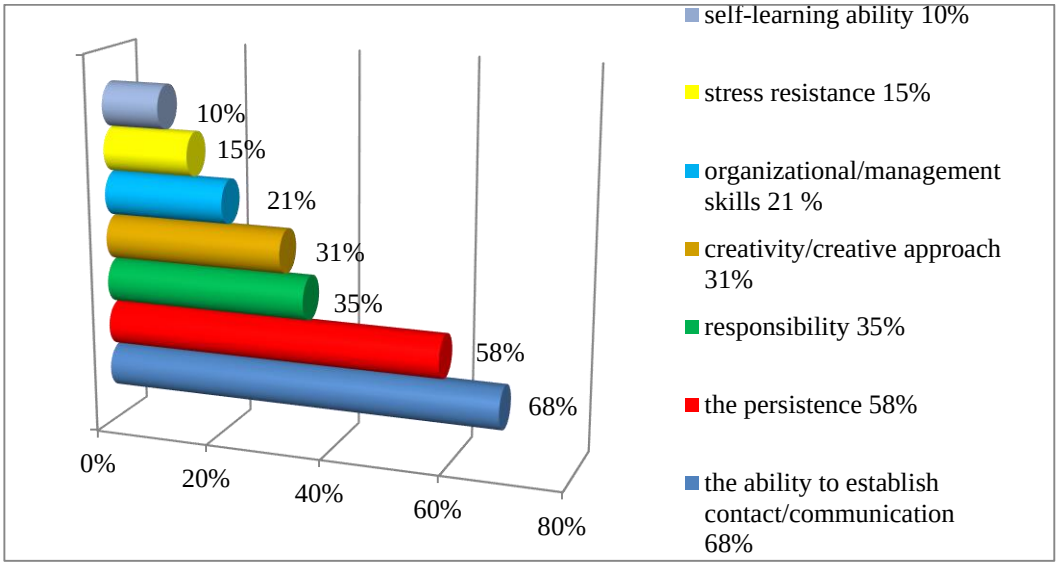


Picture 3 – Perception by future engineers of professional qualities that influence the development of innovative thinking

This indicates that students understand the importance of interaction and communication in engineering, as well as the ability to analyze and synthesize information to create new innovative solutions and products. Awareness of this can contribute to the formation of future specialists' ability to think creatively and develop innovative solutions in their field.

The fact that students do not consider the ability to design (25%) important for the development of innovative thinking may indicate that, in their perception, innovative thinking is not necessarily connected with formal design. This may mean that they perceive innovative thinking as the ability to generate new ideas, explore new paths and develop creative solutions, regardless of the presence of projects.

Having analyzed the data on the personal qualities of a specialist needed by a future engineer (this was the fourth question of the questionnaire: "What do you think are the personal qualities of a specialist needed by a future engineer?"), it can be stated that the ability to establish contact/communication is considered the most necessary (68%) and persistence (58%); while stress resistance (15%) and the ability to self-study (10%), according to the interviewees, are not important personal qualities of future engineers (Picture 4).



Picture 4 – Perception by future engineers of personal qualities that a future engineer needs

The ability to establish contact and sociability is recognized by respondents as the most important personal quality of future engineers. This highlights their understanding of the importance of effective communication and the ability to interact with other professionals, clients and the team. In engineering projects, there is often a need to clarify complex technical aspects, discuss innovative ideas and work together on tasks. Therefore, the ability to communicate effectively is considered a prerequisite for success in the engineering field.

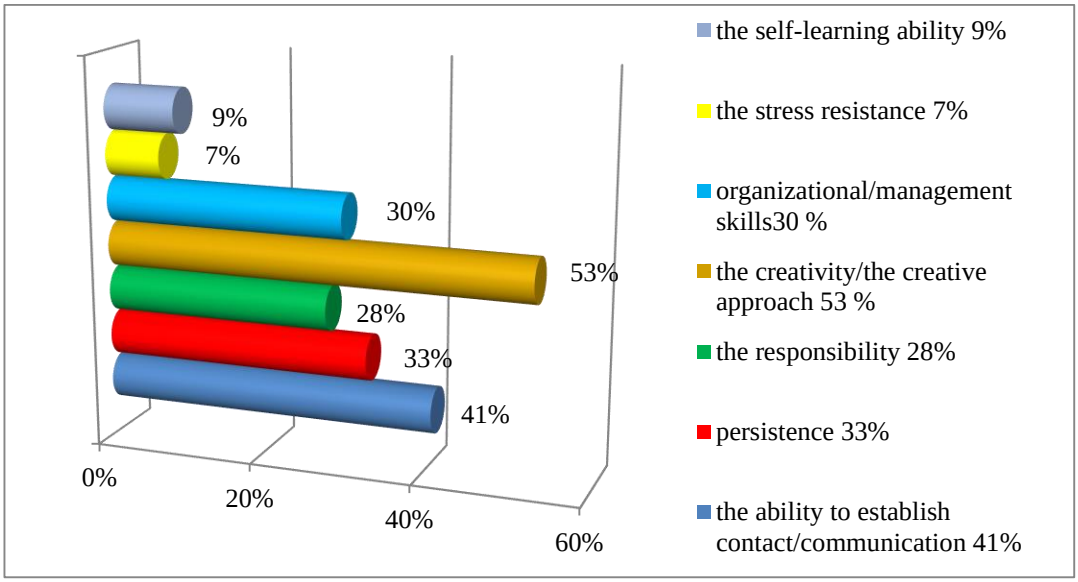
Persistence is recognized by respondents as the second most important personal quality of future engineers. This shows the students' understanding that their future profession requires focus

and the ability to work hard on complex problems. Engineers are often faced with tasks that require long-term work and the search for innovative solutions. Perseverance helps not only to set ambitious goals but also to realize them, even in difficult situations. Project selection, research, development and implementation of innovations require persistence and dedication to the goal.

Stress resistance and the ability to self-learning received a smaller percentage of responses (15% and 10%, respectively) and, according to the survey, are not important personal qualities of future engineers. This may indicate that students may underestimate the importance of resilience and self-learning in the context of an engineering career. In general, these findings indicate that the interviewees perceive communication and persistence as key personal qualities of future engineers. However, it is also necessary that they realize the importance of stress resistance and self-learning in preparing applicants to work in today's innovative environment.

Among the personal qualities of a specialist that influence the development of the innovative thinking of a future engineer (this was the fifth question of the questionnaire), were named the most important: creativity/creative approach (53%) and the ability to establish contact/communication (41%) (Picture 5). While the ability to self-studying, according to respondents (9%), does not have a great impact on the development of innovative thinking of the future engineer. This shows that students understand that the ability to think creatively and generate new ideas is a key factor for the successful development of innovative solutions in the field of engineering; the ability to effectively communicate and cooperate with colleagues, customers and the team is important for the implementation of innovations in practical activities. But, unfortunately, the ability to self-studying is not considered by the respondents to be basic or important for the development of innovative thinking of future engineers. This means that students may underestimate the importance of self-directed learning in the context of innovative development.

In general, these findings highlight the importance of creativity and sociability for the development of innovative thinking in future engineers. However, it is also worth considering the possibilities of increasing students' awareness of the role of self-learning in their professional career and innovative development.



Picture 5 – Perception by future engineers of personal qualities that influence innovative thinking

Conclusions. The results of the study show that communication, the ability to make calculations and the ability to think abstractly are considered by students to be the most important professional qualities. The ability to establish contact and sociability and perseverance are the most important personal qualities of engineers. However, future engineers are not sufficiently aware of the need and importance to apply knowledge from technical disciplines. Stress resistance and the ability to self-studying, which requires educational additional work with students.

According to the results of our survey, the respondents believe that communication skills, the ability to establish contact, the ability to analyze and synthesize, and creativity (a creative approach) have the greatest influence on the development of innovative thinking of future engineers self-learning ability.

As we can see, students believe that communication skills have the greatest influence on the development of innovative thinking. However, we understand that while the ability to discussing one's ideas and sharing ideas may be important for engineering innovation, thinking, fundamental mathematical and technical skills are undervalued. We believe that in the future it is necessary to find out why students consider communication to be such an important quality for the development of innovative thinking. Further work is necessary for students to understand what the innovativeness of an engineer means and what qualities, knowledge, skills and abilities are necessary for the production of new ideas, their development, calculations and substantiation.

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