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Tatyana KHOKHLOVA,
Doctor of Engineering, Professor, Director of the Educational-Scientific Institute of Integrated Education of the National Metallurgical Academy of Ukraine
kh_gipo@ukr.net

Yurii STUPAK,

Doctor of Engineering,
Assistant Professor of the Sub-faculty of Theory, Technology and Automation of Metallurgical Processes of the National Metallurgical Academy of Ukraine
ORCID ID 0000-0002-7199-057X
yr_st@ukr.net

Herman SAVCHENKO,
Senior Teacher, Director of the College of the National Metallurgical Academy of Ukraine

CONTENT AND QUALITY OF BASIC EDUCATION AS AN ESSENTIAL FACTOR IN THE QUALITY OF PROFESSIONAL TRAINING IN A MODERN TECHNICAL INSTITUTION OF HIGHER EDUCATION

Formulation of the problem.

The experience of the Educational-Scientific Institute of Integrated Education (IIE) and the College of NMetAU has shown that a significant number of entrants who are accepted to study have a low level of training in basic school subjects (mathematics, physics, chemistry). The main problem that teachers constantly deal with is the low level of residual knowledge of freshmen, due to which a significant number of classroom hours are forced to recover knowledge, as if acquired in school, but largely lost at the beginning of training.

According to the authors, one of the main reasons for this situation is the discrepancy between the content and quality of entrant's basic education entering the study, the content of training in higher education, where, in terms of reducing the workload (including practices of all kinds), increasingly difficult to meet of the employers requirements to the level of training. This is a serious problem for almost all technical universities, and the search for ways to solve it, including dual learning, the introduction of practice-oriented methodological approaches, is an urgent task in the near future.

The purpose of the article is to determine the key principles for organizing of specialists training in engineering specialties, which would ensure the professional competencies formation of future specialists in accordance with the employers requirements and higher education standards.

Analysis of research and publications. Quite widely relevant issues of modern education are analyzed in the work "Four-dimensional education", which was published by the Boston Center for Curriculum Redesign in 2015 *(Fadel, Bialik & Trilling, 2015)*. The authors rightly emphasize that any education program in the 21st century must be flexible

and open to continuous improvement. But a truly flexible program will never be completed and completed for several reasons. The main ones were the constant growth of the knowledge base of mankind and the inability to take into account the various individual abilities of individual students, which is why it is extremely important for many areas, including not yet existing, there is an individualization of learning, its focus on the personal needs of students, their interests and personal development goals. It should be noted that the individualization of education, as well as other ways to improve the education quality, mentioned by the authors *(Fadel, Bialik & Trilling, 2015)*, have not only been actively studied by Ukrainian researchers for many years, but also embodied in basic legislation. Thus, back in 2017, the Law of Ukraine "On Education" *(Law, 2017)* introduced such categories as "student's individual educational trajectory", "individual development program", "individual curriculum", which were later reflected in the Laws of Ukraine "On Professional Higher Education" *(Law, 2019)* and "On Complete General Secondary Education" *(Law, 2020)*.

In Ukraine, the problems of modernization and development of the education system in the XXI century are devoted to many thorough studies, including V. Andrushchenko, V. Bykov, M. Zgurovsky, I. Zyazyun, V. Kremen, V. Lugovoi, E. Luzik, V. Lutaya, N. Nychkalo, S. Nikolaenko, V. Ognevyuk, V. Oliynyk, O. Savchenko, M. Yarmachenko and others. After analyzing the numerous works on the education renewal problems, we took into account the documents and works devoted to the key, in the context of the objectives of this article, problems:

- personality-oriented aspects of modern pedagogical technologies based on the competence approach *(Khutorskaya, 2003; Zimnyaya, 2004; Lugovyi, Slyusarenko, & Talanova, 2012)*;
- introduction of a 12-year school and the influence of school duration on further educational achievements (A. Vasyliuk, K. Garashchuk, O. Lokshina, etc.);
- issues of vocational education development in modern conditions (N. Nychkalo, S. Nikolaenko, A. Belyaeva, G. Kruglikov, etc.);
- providing professional training for students of higher educational institutions (O. Gavrilyuk, I. Gavryk, I. Dychkivska, O. Kiyashko, L. Knodel, etc.);
- some aspects of the dual education introduction in Ukraine *(Dernova, 2014; Round table, 2018; Concept, 2018; Regulations, 2019)*;
- problems of implementation in educational institutions of STEM-education (works of O. Baturlin, O. Budnyk *(2019)*, D. Vasylieva, O. Hrytsiuk *(2019)*, S. Kyrylenko, L. Klymenko, N. Morse. I. Savchenko, I. Chernetsky, V. Sharko and others).

Theoretical principles of transformation of the content and quality of school education

The analysis of research and publications on a range of issues listed above can begin with an analysis of the relevance and demand for school subjects from ancient times to the present, which is presented in the paper *(Fadel, Bialik & Trilling, 2015)*. It is quite logical that in the Renaissance among the traditional subjects studied long ago (reading / writing, arithmetic, geometry), new ones, namely biology, chemistry and physics, along with algebra and other disciplines that provide tools for complex modern calculations. To these relatively modern fields of knowledge (disciplines) today should be added *computer*

science, which from the late 80's - early 90's became an integral and mandatory component of basic education at the primary school level.

In this context, it should be noted one of the current modern areas of modernization and innovative development of natural sciences, mathematics, humanities education, which is STEM-oriented approach to learning *(Dzyabenko, Budnyk, 2019)*. As noted in the guidelines *(Methodological Recommendations, 2017)*, this approach assists the promotion of engineering and technology professions among young people, raising awareness of their career opportunities in engineering, the formation of sustainable motivation in the study of disciplines based on STEM- education. In the work of O. Hrytsiuk it is noted that the use of STEM-technologies in education will help to overcome a number of significant problems, among which the author lists the most important *(Hrytsiuk, 2019)*.

T. Nenastina in her work analyzed the relationship between the quality of school knowledge in chemistry and the professional competence formation in students while studying at the university *(Nenastina, 2018)*. It was shown that the main reasons for the difficulties that arise in students of certain specialties in studying chemistry and a number of special disciplines at the university are related to the small number of hours for chemistry studying at school and, as a consequence, the small number of applicants chemistry. To this we can only add that a similar situation is observed in physics. According to the reports of the Ukrainian Center for Educational Quality Assessment (UCEQ), there has been a gradual decrease in the relative number of graduates who choose EIT in chemistry and physics. This is fully in line with the all-Ukrainian trend of declining interest of potential entrants in engineering specialties.

According to a study by V. Mironov, during the period from 1887 to 1987 in pre-revolutionary Russia and later in the USSR, the average duration of the population education increased from 0.59 to 8.88 years, or almost 15 times *(Mironov, 1991)*.

Similar data on the schooling duration in European countries are given in the works of Stefan Thomsen from the University of Hanover *(Thomsen, 2015)* and an analytical article by O.I. Lokshina, who also analyzed the data of the European Commission (EC) on the compulsory education duration in the EU and Europe in the 80s of the twentieth century – in the early twentieth century *(Lokshina, 2017; Key Data, 2012)*.

A.B. Shur has repeatedly emphasized that increasing of the education duration does not solve the problem of the school education quality. In his works, he studied the causes and consequences of imperfect methods of mathematics teaching at school, and suggested ways to correct the situation *(Shur, 2010, 2012)*.

According to UN statistics, in the countries with the highest human development index (according to UN criteria) the average duration of training (the first 30 countries in the ranking) is 12.3 years *(Human development indices and indicators, 2018)*. Similar processes have taken place in Ukraine in recent decades. As a result, the transition to a 12-year school in Ukraine was finally enshrined in law at the beginning of 2020 *(Law, 2017)*. This growth does not contradict the global trends we pointed out above *(Thomsen, 2015; Lokshina, 2017; Key Data, 2012; Human development indices and indicators, 2018)*.

In November 2014, during the discussion of the draft Concept of Education Development for 2015-2025, measures for further development of all education levels were envisaged, including the introduction of a "zero" course in universities. The idea, according to the authors, is quite valid. The peculiarities of pre-university training of high

school students in Ukraine are thoroughly considered in the work of N. Muranova *(Muranova, 2015, pp. 44-45).*

L. Potapyuk, proposing the main ways to increase of the future professional's professional competence, rightly notes that "… the employer needs a specialist who is able to maximize their potential, mobility, flexibility, competitiveness and professional competence…" *(Potapyuk, 2018, p. 44).*

Authors from Ivano-Frankivsk NTU of Oil and Gas link the difficulty of the modern specialist's competence forming - mining engineers with the need to combine deep fundamental knowledge, special knowledge of mining engineering and engineering, as well as - entrepreneurial art *(Ozarko, Knysh & Moiseenko 2014).*

A. Kokareva emphasizes that "…the main attention of teachers should be paid to the development of the student's personality, his communicativeness, ability to acquire and deepen knowledge, think and work in a new way. Important tasks … are the integration of universities with research institutions and industry, which will stimulate of the priority areas development in the format of "science-training-practice-technology" *(Kokareva, 2017).*

V. Bobrytska, considering the pedagogical conditions of specialist's professional adaptation with higher education, rightly notes that the success of adaptation largely depends on how it is perceived by a specialist on a personal level, taking into account changes in communication, increased workload, learning a new social role. It is emphasized that a young specialist should cultivate such qualities as endurance, self-esteem, confidence and others *(Bobrytska, 2015).*

In the N. Batechko work it is noted that the quality of education, as part of the actual education system, which is open, can also be considered an open system *(Batechko, 2017).* I. Parubchak, O. Smolinskaya et al. this approach to social management in the cultural and educational space of universities is characterized as environmentalism, so we consider it justified to apply it to the quality of education too, as this logically provides for constant content adjustment (list of features) with take into account of environment changes *(Parubchak, Smolinska & Marszałek-Kawa, 2019).*

A positive shift in ensuring the quality of training for industrial enterprises is a dual education system introduction in Ukraine. In our opinion, it is in this area that the strategy of further engineering education development (both higher and vocational) should be implemented as one that is closest to the educational services consumers needs and therefore able to fully meet their.

Practical experience in implementing the principle of unity and continuity of school, higher education and professional activities of graduates at the Institute of Integrated Education (IIE) and the College of NMetAU

In order to monitor the final knowledge of basic school subjects until further updating of knowledge in 2017/18 and 2018/19 school years with primary school students (specialty 136 - Metallurgy) was a rapid test for residual knowledge in mathematics, physics and chemistry provided. According to the theory of testing *(Avanesov 2002, 2005)* sets of tasks in the test form which included tasks of various levels of complexity from corresponding disciplines were developed.

For the next task to improve of the training quality, namely - analysis of the needs and requirements of employers, IIE (at the Nikopol Faculty of NMetAU) was proposed and conducted a survey, which covered about 10 leading companies in Nikopol *(Zinchenko, Savchenko, Stupak & Bobkova , 2017)*. During of the obtained results analysis, a comparison was made between the shortcomings identified by employers and the list of general competencies of the graduate majoring in "136 - Metallurgy", which are specified in the current standard of higher education in Ukraine for this specialty *(Standard, 2018)*. The comparison showed that some general and professional competencies of young professionals from the list of competencies provoke of employers remarks due to their lack. Because of this, there are difficulties with achieving program learning outcomes, as indicated by employers in the survey. The authors suggested the possible reasons for this situation.

Analysis of the rapid testing results and feedback from employers on the quality of training allowed to formulate general methodological approaches to adjusting learning trajectories (depending on the specialty) in order to form the necessary professional competencies of future professionals in accordance with requirements of employers and standards of higher education.

Conclusions and prospects for further research

Given the above, as well as the experience of the IIE and the College of NMetAU, important tasks to improve of the specialists training quality in engineering specialties in a modern institution of higher education are as follows:

1) monitoring and updating of knowledge in basic school subjects (mathematics, physics, chemistry);

2) study of the needs and requirements of potential employers regarding the amount of graduates knowledge and skills;

3) implementation of the dual form of education (or its individual elements) as one that is an effective means for improving of the training quality;

4) adjustment of the educational process content taking into account the level of residual knowledge of persons admitted to training and the potential employer’s requirements.

The main result and achievement in today's realities should be considered a stable demand for specialists trained by the Nikopol Faculty of NMetAU and the College of NMetAU. In some cases, it was even possible to increase the number of students whose tuition is paid by employers (contract form).

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