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# SOME ASPECTS OF THE TRAINING OF STUDENTS OF TECHNICAL TRADE

The modern variety of engineering specialties has its own nuances. A significant advantage of these professions is the high demand for highly qualified, competent specialists, real opportunities for career growth, and decent salaries.

Leading universities have clear tasks that are defined by the terms «quality education», «abilities», «competencies», and «competitiveness», which should be possessed by the subjects of the educational process.

A survey of more than 700 enterprises by World Bank economists (Antoniuk V., 2019) showed that more than 60% of employers are not satisfied with the level of qualifications. In particular, 70% are dissatisfied with practical skills, 55% with the level and relevance of knowledge and skills. The growth in the number of unemployed people with higher education is due to the mismatch between the scope, structure and quality of training.

While in 2010, the share of people with complete and basic higher education was 23,7% of the unemployed (in 2000, it was 14,3%), in 2017 it was almost a third – 28,8%.

An electrical engineer is a specialist who develops, manufactures, and operates electronic power systems. Focusing on the educational and qualification characteristics of a specialist in the field of study 7.050701 «Electrical Engineering and Electrical Technologies», occupation 7.05070103 «Electrical Power Systems», we will provide a list of the main competencies of a future specialist in a technical specialty that are formed during training:

- ability to choose optimal methods and technical means of creating power consumption systems;
- searching for and analyzing the causes of problems in electricity consumption, developing measures to prevent them;
- search for ways to improve the quality and reliability of electricity consumption.

The issue of the current state of professional training of engineers at universities has been the subject of many studies. The problems discussed by scientists have become particularly relevant in 2020–2022. This is due to the massive transition to distance learning, an increase in the share of independent work of students, and the complication of communication between students and teachers.

The use of the latest learning technologies allows us to achieve high-quality results in education, improving the process of teaching and management activities, and increasing their efficiency.

One of the tools to improve the quality of education is to improve the assessment system and stimulate students' interest in gaining knowledge. Modern learning technologies offer a wide range of applications of this approach, such as electronic distribution of educational material, real-time communication between students and teachers, digital online libraries and other educational resources.

The specifics of teaching students of technical specialties are determined by the nature of the material studied (volume, complexity, informativeness, focus on practical skills). In the process of studying, a student spends a significant amount of time searching for and selecting the necessary information in the presence of databases with a large amount of materials. Therefore, training materials should be prepared in accordance with certain requirements, focused on continuous analysis of promising areas of science and technology development, anticipate difficulties that may arise in the process of learning the material, and provide for the possibility of their diagnosis and correction.

Even the most advanced learning technologies cannot completely replace the teacher in the classroom. However, their use by the teacher removes the problem of lack of time to prepare for the class, opens up new opportunities for different ways of acquiring new knowledge and processing the results of control measures. Therefore, there is a clear need for such a teaching technology that would allow to create the most effective logical content of blocks of educational material, the optimal distribution of class time between classroom and extracurricular activities, the effective number, level of complexity and procedure for involving relevant tasks in the classroom, including control measures. The process of acquiring competence should aim at forming an appropriate set of competences

***K*** (general and professional or subject-specific). In order to achieve the maximum level of competence formation, it is necessary to adjust the content of the training module, that is, to influence its quantitative parameters in a certain way ***P***.

We offer a structural diagram of the approach to building a training logic module, taking into account the principles outlined above.

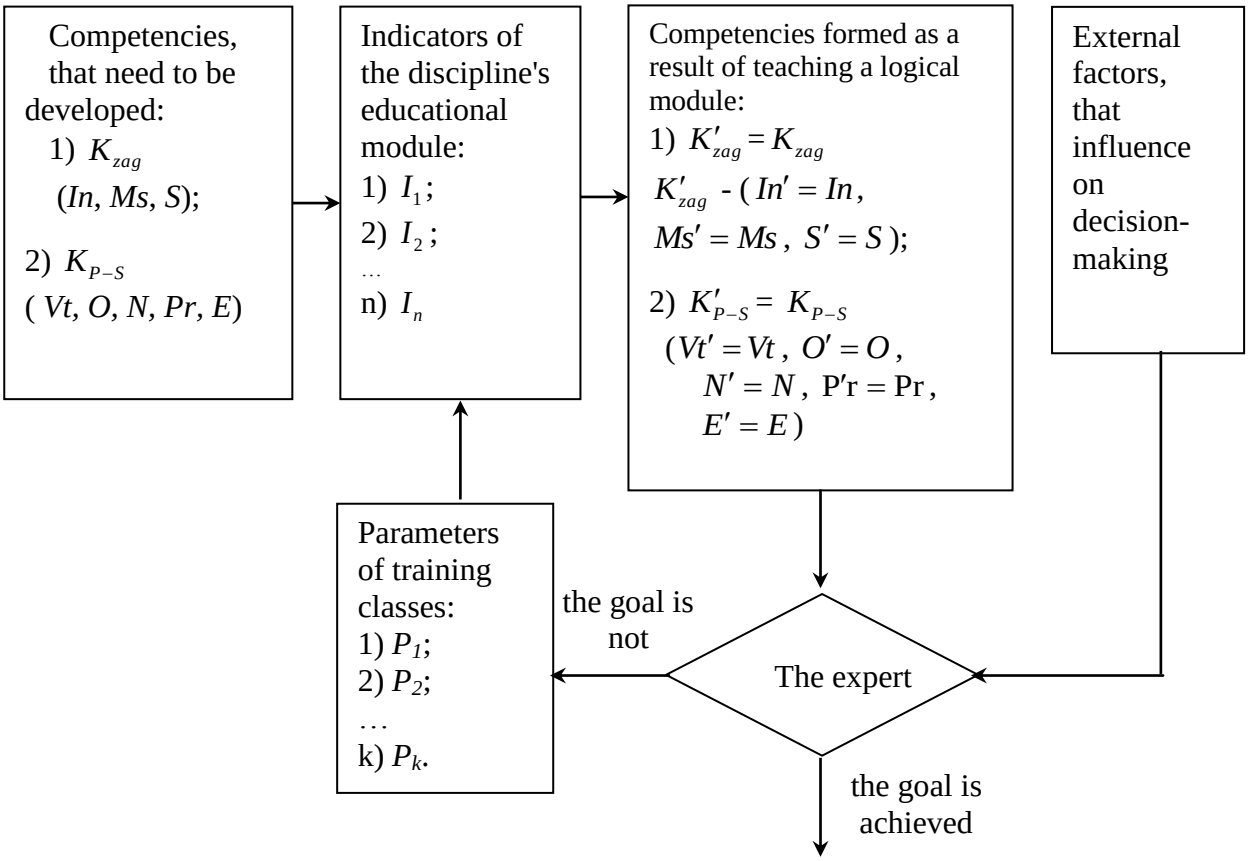


Figure 1. Block diagram of the approach to building a training logical module

According to the proposed structural scheme, this is a set of general competencies that need to be formed during the course of the logical module (during classroom and extracurricular activities)

Components of general competence: $In$ – the set of instrumental competencies, $Ms$ – the set of interpersonal competencies, $S$ – the set of systemic competencies that need to be formed during the study of the discipline. $K_{P-S}$ – the set of subject-specific competencies that need to be formed during the training logical module . Components of special subject competencies: $Vt$ – the set of production and technological competencies, $O$ – the set of organizational and managerial competencies, $N$ – the set of research

competencies, *Pr* – a set of project competencies, *E* – the set of economic competencies, $K'_{zag}$ – the general competencies formed as a result of teaching a logical module.

$In'$ – the set of instrumental the competencies, $Ms'$ – the set of interpersonal competencies, $S'$ – the set of systemic competencies formed as a result of teaching the logical module. $K'_{P-S}$ – the special subject competencies formed as a result of teaching the logical module. $Vt'$ – the set of production and technological competencies, $O'$ – the set of organizational and managerial competencies, $N'$ – the set of research competencies, $\Pr'$ – the set of project competencies, $E'$ – the set of economic competencies formed as a result of teaching the logical module. $I_1$, $I_2 \ldots I_n$ – are indicators of the discipline's educational module, with the help of which the required level of competencies is achieved.

***P1***, ***P2***, ***...*** , ***Pk*** are the parameters of training sessions included in the discipline's educational module, which are changed to influence the indicators to improve the result.

Having analyzed the structural diagram (Fig. 1), we conclude that the formation of the highest level of competence K is an optimization task:

$$f\left(P^*, K^*\right) = \min f\left(P, K\right), \qquad (1)$$

here *f* – is the objective function; *P* and *P** – are the estimated and actual parameters that influence the decision-making process for building computerized learning systems; *K* and *K** – are the estimated and actual general level of competence that is formed by the learning system.

The application of this approach to the formation of competencies of students of technical specialties allows to increase the formed level of competencies by choosing the optimal parameters of the educational process.

The derived data for optimizing the learning process using the proposed approach are the coefficients of the relationship between competencies, indicators, parameters of training sessions, and the general time limit $T_0$. It is this parameter that is crucial in determining the learning load for different forms of education for students of technical specialties.

We used the proposed approach to teaching students majoring in «141. Electric Power Engineering, Electrical Engineering and Electromechanics».

The analysis of the results of our study shows that the increase in the formed level of competencies is due to the increase in all components of competencies $K_1$–$K_4$, but the most significant impact is on competency $K_1$ – «the ability to use (apply) methods of analysis and calculation of linear electrical circuits with concentrated and distributed parameters under the influence of sources with constant, alternating sinusoidal, periodic non-sinusoidal voltages, in steady-state modes». This competence is increased by 20% with a 10% decrease in the share of hours allocated to students' independent work.

Based on the above, we conclude that reducing the complexity of tasks means using more elementary tasks, which allows students to work more deeply on more complex and comprehensive calculation methods that are studied throughout the discipline.

We have proposed a method for optimizing the parameters of the educational process by supporting decision-making on the choice of parameters of training sessions when creating an appropriate structure of the educational process and optimal distribution of time between different educational tasks, different types of training sessions can improve the level of competencies of a future engineer. It is shown that the described methods increase by 50–90% the level of competencies formed in students of technical specialties. A methodology and software implementation of the choice of parameters of training sessions is proposed, which, for example, allows, by optimizing the parameters of training sessions, namely the number and complexity of questions submitted for independent study by students, to further increase the level of competencies formed by 25–30%.

The problem of developing the interconnection of the logical modules of the discipline with each other, their qualitative content, and the use of the most optimal types of control, taking into account the specifics of the field of study and the individuality of academic groups, remains unresolved.