Chapter 29

COMPETENCE AND SYSTEM APPROACHES IN THE PROFESSIONAL DEVELOPMENT OF TEACHERS OF ELECTRICAL ENGINEERING

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INTRODUCTION

The modern world, in particular, the electricity industry, is constantly evolving, which requires a high level of qualification from specialists. Future teachers of electric power disciplines should not only have deep theoretical knowledge of electrical engineering, but also be able to form this knowledge in their students. This requires special attention to the methods of teacher training, since the quality of training depends on their professional competence.

Scientific and technological progress and the development of modern production are largely based on the use of environmentally friendly energy sources, the main of which is electric energy.

For the effective use of electric energy, qualified and competent specialists are needed, the training of which is provided by graduates of higher educational institutions in the specialty «Professional Education»[1].

Therefore, the urgent task is to improve the quality of training of teachers of practical training in the theory and practice of using electrical energy and technology. In the general pedagogical context, this task is associated with an actual problem: what contribution should the teacher of each discipline taught in a higher educational institution make to the formation of the professional competence of its graduates. In modern socio-economic conditions, society and employers place increased demands on the quality of training at various levels. They not only need to have the necessary knowledge in their professional field, but also possess the skills of their integrated application in solving production problems from the first days of independent professional activity.

The main goal of vocational education is to train qualified workers of the appropriate profile and level who are competitive in the labor market,

[1] Ничкало Н. Г. Українські концепції професійної освіти тенденції і перспективи. *Теоретико-методологічні засади неперервної професійної освіти*. С. 27–50. – p. 33

competent and responsible. To realize this goal, domestic researchers have created a solid scientific potential.

Analysis of the achievements of pedagogical science, as well as the results of fundamental and applied research of scientists, allow us to identify various approaches to solving the problems of theory and methodology of professional and vocational pedagogical education, as well as determine ways to improve the quality of training of future teachers of practical training[2].

At every stage of the life of our society, vocational education not only trained personnel for production and the service sector, it educated the Man, contributed to the development of his talent, taught him to love his native land, work for its benefit.

V. Radkevich, N. Nichkalo, V. Yagupov, Zyazyun I., Dembitskaya S. Devoted their work to the development of theoretical foundations for improving professional education.

The analysis of pedagogical literature shows that in the general pedagogical plan the problem of determining and forming the professional competencies of future specialists has recently received considerable attention. Most of them emphasize the idea of forming the professional competence of future specialists directly by teachers of disciplines, in accordance with the curriculum of the educational institution. However, many studies are limited to the general pedagogical consideration of the process of forming professional competencies without reference to specific disciplines of the curriculum. Today, scientific and practical prerequisites have already been created for improving the process of forming the professional competence of future specialists in specific academic disciplines. Analysis of the state of this problem in theory and practice revealed several key problems in the formation of professional competence in electrical engineering among future teachers of practical training in higher education.

Firstly, the pedagogical literature does not clearly reflect the essence of a competently oriented approach to training specialists. Secondly, the content of professional training of students in the field of electrical engineering does not meet the requirements of future professional and pedagogical activities of teachers of practical training. Thirdly, the coordination of activities to form the professional competence of students between teachers of different disciplines is not sufficiently organized and coordinated. And, finally, during the formation of the competence of future teachers of practical training, there is no consistency, often this process occurs spontaneously and chaotically. The above shortcomings are aggravated by a number of contradictions. The first contradiction is between the traditional goal of electrotechnical

[2] Радкевич В. О. Компетентнісний підхід до забезпечення якості професійної освіти і навчання. *Науково-методичне забезпечення професійної освіти і навчання*: матеріали Звітної наук.-практ. конф. (Київ, 29 березня 2012 р.) Київ, 2012. С. 9–15. – p. 11

education, which emphasizes the formation of knowledge and skills among students, and the requirement of a competence approach, which implies the approximation of educational goals to the future work of students [3].

The second contradiction arises between the desire to implement a competence approach in training and the unpreparedness of university teachers in this area, both in theoretical and in practical aspects.

The third contradiction concerns the need to give the process of forming professional competence in electrical engineering a systemic character, while now this process has insufficient theoretical justification. Finally, there is a contradiction between the chaotic, spontaneous nature of the formation of professional competence in electrical engineering among students and the need to organize this process based on the principles of system pedagogical design and modeling.

1. Competence approach in the context of professional development

The dynamic process of renewal of technics and technologies in electrotechnical branch puts forward high requirements to level of qualification of workers.

Therefore, at the present stage of the development of society, the role of training highly competent masters of practical training in the field of electric power industry, who have the established professional knowledge and skills, increases.

Modernization of education in a professional school is aimed at improving the training of such specialists.

However, there is a problem that the existing goal and content of vocational education do not meet the requirements of the labor market. Competence approach is aimed at bringing vocational education in line with the requirements of the labor market. It reflects the need for high-quality professional education, which is put forward by both employers and society as a whole, to train competent specialists.

Competence approach implies that the results of education are important not only in the educational system, but also beyond. There are many different views of scientists about the phenomenon of competence approach[4].

Competence approach in modern education means an emphasis on the development of competencies, that is, abilities and skills that allow the individual to act effectively in different life situations.

[3] Дембіцька С. Формування компетентності фахівців з професійної освіти. *Педагогіка безпеки*. 2021. Т. 6. № 1-2. С.1–6. – С. 2

[4] Горбан Є. Сучасні проблеми розвитку професійної компетентності методистів професійно-технічних навчальних закладів у міжкурсовий період підвищення кваліфікації. *Професійна педагогіка.* 2018. №14. С. 37–43. – с. 38

It is an approach that requires the integration of knowledge, skills and values to solve practical problems.

– the main components of the competence approach are as follows:

– functional competencies – knowledge and skills necessary to perform specific tasks.

– metacompetence – the ability to self-regulation, self-esteem and reflection.

– values and attitudes – formation of value orientations, ethics and responsibility.

– principles of competency approach implementation

– integration of the educational process – the interconnectedness of theoretical and practical knowledge.

– personalization of learning – focus on individual needs and opportunities of students.

– implementation of project training – implementation of projects by students that require the integration of various knowledge and skills.

The advantages of the competence approach are as follows:

– increased motivation of pupils to study.

– preparation for real life situations.

– development of critical thinking and creativity.

This approach contributes to the formation of a competent personality capable of independent problem solving and successful social adaptation. If you are interested in a particular aspect or scope of the competency approach, please clarify and I will provide more information.

The categorical basis of the competence approach is closely related to the idea of focusing the educational process on future professional activities. Competencies set a higher, generalized level of skills and abilities of the student, and the content of education is formed on the basis of its four-component model (knowledge, skills, experience of creative activity and experience of practical relations).

Accordingly, competence is clearly correlated with the cultural context. For example, cultural competencies and those related to leisure are a manifestation of European culture, while Ukrainian culture correlates mainly with spiritual competencies and general cultural activities.

Within the competence approach, two key concepts are distinguished: competence and competence.

Competence is a set of knowledge, skills, experience and behavioral characteristics that are necessary to perform certain tasks and achieve specific goals. Competence is the potential that a person has and includes:

– Knowledge is theoretical and practical information that a person has learned.

– Ability – the ability to apply knowledge in practice.

– Skills – automated actions and operations, the implementation of which does not require significant mental effort.

– Experience – acquired through practical activity.

– Behavioral characteristics – qualities and personality traits that affect the performance of tasks.

Competence is an integrated characteristic of a person, which determines its ability to act effectively in certain situations on the basis of acquired competencies. Competence includes:

– Flexibility and adaptability – the ability to adapt to new conditions and changes.

– Critical thinking is the ability to analyze, evaluate, and apply information.

– Communication skills – the ability to communicate effectively with others.

– Responsibility – the ability to take responsibility for the results of their activities.

– Reflection – the ability to evaluate and analyze their own activities for further improvement.

The relationship of competence and competence.

Competence is an integral part of competence. In other words, competencies are the «building blocks» from which competence is formed. Competence manifests itself in human activity, when he uses his competence to solve practical problems and achieve success in professional activity.

In modern conditions of the labor market, the presence of competence is a decisive factor for successful professional activity. Employers increasingly prefer employees who not only have knowledge and skills, but are able to effectively apply them in real situations, thereby demonstrating their competence.

Consequently, the competence approach involves not just training in theoretical knowledge, but also the development of the ability of their practical application, which contributes to the training of comprehensively developed and competitive specialists.

Despite the diversity of approaches to the definition of competence and competence, the authors remain within the proposed definitions. Competence is understood as the possession of certain knowledge, skills, life experience, allowing you to make informed judgments, perform tasks or solve problems.

Differences are observed:

– in understanding competence as actual personality qualities or hidden psychological neoplasms;

– in the interpretation of the subject fullness of competencies, which are considered as systemic neoplasms of personality qualities.

When we talk about competence as a result of mastering knowledge, skills and experience, the emphasis is on what this knowledge, skills and experience should be. However, when we consider competencies as personal neoplasms, questions of the structure of these neoplasms, the competence of their components and the relationships between these components come to the fore.

The learning process requires the identification of key competencies that form a wider range of competencies that are universal and basic for the formation of the previously mentioned competencies.

These competencies are not limited and not too specific.

Within the framework of the project «Secondary Education in Europe», the Council of Europe determined the next set of key competencies:

Study:

– organize the relationship of their knowledge and organize them;
– organize your own teaching techniques;
– independently engage in their studies;
– solve problems;
– use experience.

Search for:

– different databases
– interrogate the environment;
– receive information;
– work with documents and classify them;
– consult an expert.

Think:

– organize the relationship of past and present events;
– critically perceive information and any phenomena of reality;
– implement cognitive activity in conditions of vagueness and complexity;
– defend their position in discussions;
– evaluate political and economic systems, the environment in which training, work;
– evaluate social habits according to the criterion of «healthy lifestyle» in accordance with the degree of formation of environmental consciousness;
– evaluate works of art and literature.

Get down to business:

– be included in the project;
– be responsible;
– determine your place in the group and in joint activities;
– prove solidarity;
– jganize your work;
– use personal computers.

Cooperate:

– interact and work in a group;
– make decisions;
– constructively resolve conflicts;
– negotiate;
– develop and execute contracts.

Adapt:

– use new information and telecommunication technologies;
– have flexibility of thinking;
– find new solutions in problematic, non-standard, uncertain and complex situations.

Today, when discussing issues of a new quality of education, this term is increasingly used to refer to new results of general education.

This is how it is interpreted in the domestic concept of modernization of education. At the same time, the pedagogical community continues to discuss the concretization of the concepts of «competence», the definition of key (universal) competencies, as well as ways to form and evaluate them.

Basic competence is a competence that is responsible for its nature and degree of suitability for this specialty. It can be called professional competence.

Competence is a characteristic of a person with knowledge, experience to perform a specific activity.

Professional competence is a characteristic of a person that means performing his own actions with the necessary quality, established standard and regulatory documents.

The concept of competence-oriented education should be the basis for creating conditions for the reorientation of educational institutions to a competence-based approach to education, identifying mechanisms for the formation of key competencies of applicants for higher education and mechanisms for assessing the teacher's activities to form key competencies of applicants for higher education.

The terms «competence» and «competencies» are increasingly used instead of the concept of «professionalism» (human mastery of various technologies, such as material processing, accounting, machine design, crop cultivation or construction work).

Competence, in addition to technological training, includes a number of other components, which are mostly non-professional in nature, but today are necessary for each specialist.

In essence, the competence approach is aimed at acquiring the abilities and skills necessary to effectively perform professional functions in the workplace.

2. Systematic approach to the training of teachers of electrical engineering: Professionogram as a key element

The purpose of the system of formation of electrical competence of the teacher of practical training is to create a model of its training. There are different approaches to building educational models of a specialist, each of which has its own unique characteristics and features.

Different scientists put different content in the concept of «model specialist». For most researchers, this model is a descriptive analogue, reflecting the main characteristics of the object being studied. This is a generalized image of a specialist of a certain profile, which corresponds to the philosophical definition of modeling.

The concept of «model specialist» is a multifaceted and important element in the field of training. It describes in detail the knowledge, skills, abilities and competencies that should be inherent in a professional in a particular field. This model is a kind of standard that educational institutions and employers are guided by when training and using specialists (Fig. 1).

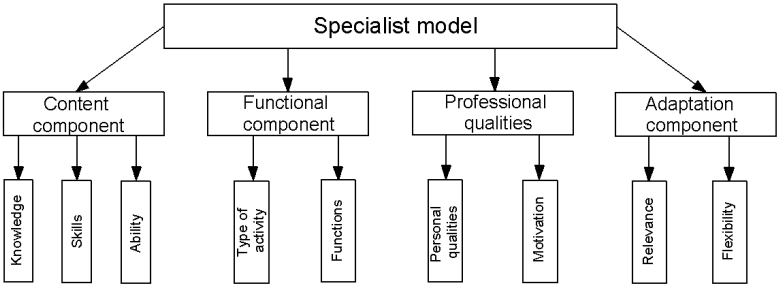

Fig. 1. Components of the model specialist

According to Figure 1, the main aspects of this concept contain the following important components:

1. The content component, which in turn includes:

– Knowledge is the theoretical basis that a specialist must possess (for example, the principles of electrical engineering for an electrical engineer).

– Skills are practical abilities to perform specific tasks (for example, installation of electrical wiring).

– Skills are proven actions that are performed automatically and with high quality (for example, rapid diagnosis of malfunctions).

2. Functional component:

– Activities: different types of work that can be performed by a specialist (industrial, managerial, scientific, pedagogical, etc.).

– Functions: specific tasks performed by a specialist within his professional activities (for example, project management, research and development, student training).

3. Professional qualities:

– Personal qualities: traits that contribute to the effective performance of professional duties (for example, responsibility, sociability, stress resistance).

– Motivation: internal and external factors that stimulate the specialist to professional growth and self-improvement.

4. Adaptation component:

– Relevance: the ability of the specialist model to constantly adapt to changes in technology, the labor market and social conditions.

– Flexibility: the ability to update the content of training programs in accordance with modern requirements and new knowledge.

Building a specialist model is a complex process that involves the interaction of educational institutions, employers, industry experts and scientists. This model allows you to prepare specialists who meet the modern requirements of the labor market and are able to effectively perform their professional duties.

The modern model of a specialist, which functions as an integrated educational system, is constantly being improved on the basis of the current requirements of practice. These requirements are reflected in the information about the professional activities of specialists, their qualification qualities, acquired skills and other characteristics. Thus, the model of training a teacher of practical training is constantly adapting to changes in the professional sphere and meets modern standards and needs.

There is a concept according to which the model of a specialist is determined by curricula, programs and other official documents. However, a significant part of scientists believes that such a concept has shortcomings. It does not take into account all aspects of specialist training and may be limited in reflecting real working conditions and requirements for professional activities.

The modern educational system requires a flexible approach that allows you to adapt the curriculum to the new challenges of the professional sphere. Improving the model of training should take into account not only theoretical knowledge, but also practical skills, communication skills and the ability to innovate. This will prepare specialists who will be able to operate effectively in the dynamic conditions of the modern labor market, respond to the challenges of the time and contribute to the development of the industry.

In many educational institutions of the country, approaches to creating a specialist model have evolved in the direction of a detailed description of the types of activities and functions performed in the workplace, as well as the definition of knowledge, skills and skills necessary to perform these functions.

This approach contributes to a more accurate and objective formation of the competence of future specialists.

The adopted concept of the specialist model, which considers its activities as an analogy of real professional practice, allows solving several key problems. First, obtaining an accurate and detailed description of professional activities directly in production helps to develop training programs that meet real needs. Secondly, such a concept allows us to identify inconsistencies between the training of specialists in educational institutions and the specific requirements of professional activity. This allows you to adjust the learning processes and improve the effectiveness of training.

In addition, modern approaches to creating a model of a specialist include an analysis of the current requirements of the labor market, which makes it possible to prepare specialists capable of innovation and rapid adaptation to changes. An important aspect is also the development of soft skills, such as communication abilities, leadership and teamwork skills, which are key to successful professional activity in the dynamic conditions of the modern world.

This model contributes to a more adequate and responsible approach to the training of specialists, which meets the modern requirements of the labor market and ensures their high professional level. It allows you to train specialists who have the necessary knowledge, skills and abilities for successful professional activity.

The formation of models of specialists can be carried out at different levels, depending on the goals and objectives. Usually, two main groups of goals can be distinguished when developing models of specialists:

1. **Obtaining and processing information for implementation in the educational process –** this includes adapting the content of curricula, plans and materials in accordance with new knowledge and technologies. This approach ensures the relevance of training materials and techniques, which, in turn, contributes to improving the quality of training.
2. **The use of specialists in a particular field –** this involves the development of job descriptions, passports of specialties, requirements for positions and other documents that help to clearly define the roles and responsibilities of specialists in their professional activities. This approach helps to improve efficiency, as specialists have a clear idea of their tasks and responsibilities.

In addition, modern models of training should take into account the trends and requirements of the labor market, which will ensure their competitiveness. This includes the development of soft skills such as communication ability, leadership and teamwork ability that are key to successful professional performance in the dynamic environment of today's world.

In many developments of the specialist model, activities focus on the following key aspects:

1. Production and technological activity – this type of activity covers the development and implementation of technological processes and solutions

that ensure production efficiency and high quality of products. Specialists engaged in this activity should have deep knowledge in the field of technology and innovation.

2. Organizational and managerial activities – this aspect includes planning, coordination and management of various aspects of professional activity. Specialists in this field should be familiar with management methods, strategic planning and be able to effectively organize work processes.

3. Design and technological activity – this type of activity is aimed at designing and creating technical systems and devices. Specialists engaged in this activity should have the skills to design and develop innovative solutions.

4. Teaching activities – this activity covers the development and implementation of teaching materials and programs that contribute to improving the quality of education and training. An important part of this work is the adaptation of teaching methods to modern requirements and technologies.

5. Educational activities – this aspect of the activity involves the development of pedagogical approaches and methods for training specialists. Specialists in this field are engaged in the education of future professionals, forming their competencies and professional qualities.

Such approaches allow us to create a comprehensive model of training specialists that meets the modern requirements of the labor market and provides high quality of professional training.

This approach to the development of models of specialists provides a more comprehensive and systematic way of preparing them, allowing you to take into account all aspects. A number of studies emphasize the need to create a hierarchical structure of the model. This is due to the fact that some activities are common to graduates of all educational institutions. These activities include communication with people, management and mastery of self-education methods. That is, these are activities that are associated with worldview, moral, ethical and general cultural norms of human behavior.

Creating a hierarchical structure of the specialist model allows you to more accurately determine the levels of competence necessary to perform professional duties. It also contributes to the formation of a holistic system of training, which includes not only specialized professional skills, but also cultural values and moral and ethical norms. This approach ensures harmonious personal development and contributes to the successful adaptation of graduates to the professional environment.

Taking into account all aspects of training allows you to create curricula that meet the modern requirements of the labor market and ensure high competitiveness of graduates. It also contributes to the formation of sustainable professional qualities necessary for successful professional activity in the dynamic conditions of the modern world.

Information on the characteristics of activities usually includes a description of the main aspects and requirements associated with the performance of certain professional activities. The main categories of activity

characteristics that can be included in the models of specialists contain the following components:

1. **Production and technological activities:**
   - Development and implementation of technological processes.
   - Use of modern technologies and innovations.
   - Ensuring production efficiency and product quality.
2. **Organizational and management activities:**
   - Plan and coordinate workflows.
   - Management of personnel and resources.
   - Strategic planning and management decision-making.
3. **Design and technological activities:**
   - Design of technical systems and devices.
   - Development of innovative technical solutions.
   - Analysis and improvement of existing technical systems.
4. **Educational and methodological activities:**
   - Development of teaching materials.
   - Implementation of new teaching methods.
   - Adapting applications to modern requirements.
5. **Educational activities:**
   - Development of pedagogical approaches and methods.
   - Formation of competencies and professional qualities.
   - Training of future specialists for professional activities.

These characteristics of activity allow you to accurately determine the tasks that a specialist performs in his professional activity, and provide an integrated approach to the training of specialists that meets the modern requirements of the labor market.

A description of what tasks and functions a specialist should be trained for, as well as what qualities and skills he should have, is a specialist model.

Based on the analysis of the State Classifier of Professions, the Unified Tariff and Qualification Directory and the Educational and Qualification Characteristic of the Training of a Teacher of Practical Training in the Field of Electric Power Industry, we have identified priority professional actions, functions and skills that a specialist should have:

- **Professional actions –** performance of technological processes and operations, analysis and assessment of production situations, ensuring the continuity and quality of production processes.
- **Functions –** planning and organization of work processes, management of personnel and resources, control and assessment of the quality of work.
- **Skills and qualities –** knowledge of modern technologies and production methods, ability to quickly adapt to changes and solve non-standard situations, communication skills and ability to work in a team, leadership qualities and ability to make managerial decisions, ability to self-education and constant professional development.

This approach allows you to create a specialist model that meets the modern requirements of the labor market and contributes to the high quality of specialist training (Table 1).

Figure 2 presents a model of the structure of professional activity of a specialist.

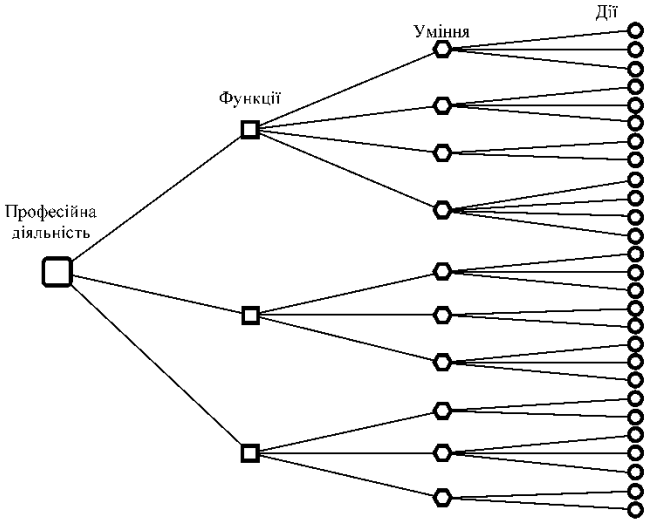

Fig. 2. Model of the structure of professional activity of a specialist[5]

The specialist model is a key factor in the selection of the content of education and forms of its implementation in the educational process.

Recently, there has been a tendency to develop various models of specialists that provide a clear and adequate representation of future professional activity and contribute to effective preparation for it.

The choice of basic properties in personological models is based on the concept of a multifactor personality structure. This approach assumes that for modeling the training and professional activities of practical training teachers and electrical engineers, the most effective are professional personality models. The professionographic approach allows you to create detailed professionograms that determine the professional suitability and contribute to the successful implementation of the processes of professional selection and professional selection.

[5] Васюченко П. В. Формування професійної компетентності з електротехніки у майбутніх викладачів електроенергетичних дисциплін: дис.… канд. пед. наук: 13.00.04. Чернігів, 2011. 231 с. – p. 32

Table 1[6]

Competent profiles for professionals at different stages of career development

Professions	Functions	Skills	Actions
Electro-installer, electro-monter	– repair of power and lighting electrical installations with electrical circuits of medium complexity; – maintenance and prevention of repair of internal power lighting wiring.	– troubleshooting in power and lighting electrical wiring, electric motors, start-control equipment; – overhaul of power and lighting wiring.	– execution of electrical installation works; – reading electrical diagrams; – installation of electric drives; – installation of devices and automation tools; – installation of overhead cable lines; – installation of transformer substations; – execution of locksmith works; – performance of rigging works.
Electrical Engineer	– professional activity electrician for the operation of electrical equipment and automation at enterprises	– technical operation, maintenance and repair of transport electrical equipment and automation; – organization of adjustment, adjustment and inspection of electrical equipment; – assessment of production activity efficiency; – safety analysis; – preparation of technical documentation for modernization and modification of electrical equipment; – use of normative and reference literature.	– finding effective solutions to problems in the field of professional activity; – use of computer equipment and technologies; – self-education, self-development, self-improvement; – proficiency in professional vocabulary; – calculation of parameters of typical circuits of electrical and electronic devices; – control of electrical products quality compliance with the established standards.

In particular, professional models allow us to visualize future professional activities, which facilitates the training of specialists and ensures their effective professional adaptation. This approach helps to form a comprehensive portrait of a specialist, taking into account all the necessary competencies and skills for successful professional activity.

[6] Васюченко П. В. Формування професійної компетентності з електротехніки у майбутніх викладачів електроенергетичних дисциплін: дис.… канд. пед. наук: 13.00.04. Чернігів, 2011. 231 с. – p. 32

Considering in detail each of the components of the professionogram, it can be seen that these parts are in good agreement with the components of the professional competence of a specialist. For example, the workogram reflects the purpose and mission of the profession, its prevalence, goals, subject, means, conditions, product of work, as well as knowledge, skills, ways of performing professional activities, possible levels of professionalism and qualification categories, the rights of representatives of this profession, job duties. This largely corresponds to the technological and special components of professional competence.

The psychogram includes a description of the motives, goals, tasks and needs of a person in the chosen profession. It also covers value orientations, relationships, emotions and mental states, the level of satisfaction with work, its process and results. In addition, the psychogram contains psychological requirements and contraindications to professional activity, its positive and negative aspects, psychological characteristics of professional growth and possible trends in the degradation of professional activity, professional claims and self-esteem. All these aspects correspond to the psychological component of professional competence.

Sociogram describes socially significant qualities of the individual, such as sociability, organizational skills, mobility and others. It also reflects the social significance and relevance of the profession in society, establishes social norms of behavior in professional activity, includes rules of subordination and professional culture. Sociogram explores the adaptability of the individual in the profession to various influences of the external environment, creativity and the possibility of enriching professional experience. It also includes value orientations, relationships and positions in professional activities, as well as the ability to professional learning and self-development. Professional thinking is an integral part of the sociogram, because it determines the ability of a specialist to analyze, make decisions and innovate in the professional field.

These aspects describe the specialist in terms of social, managerial and communicative components of professional competence. The analysis of the composition and structure of the qualification characteristics of specialists made it possible to develop a comprehensive professionogram, which includes a trudogram, a psychogram and a sociogram of a practical training teacher and an electrician. This professionogram reflects the modern requirements of society for their activities (Fig. 3).

Competence, as an integral characteristic of a specialist, includes professional, socio-personal and universal (super-professional) abilities of a person, allowing him to successfully solve both current and future professional tasks. Competence consists of competencies that are classified

into key, which are necessary for all graduates without exception, and basic professional, corresponding to a specific specialty.

Key competencies can be divided into two blocks:

– The first block: the ability to develop readiness for self-educational activities (to learn, to seek information, to think critically).

– The second block: the ability to develop readiness for production activities (initiate projects, cooperate with others, adapt to changes).

Readiness for self-education and production activities is not directly related to a specific profession. These skills can be used as invariant indicators to compare different forms of training, regardless of the specifics of professional activity. This approach allows the assessment of competencies at the general level, which is important for generalized analyses and the development of universal educational programs.

Basic competencies can be divided into three main groups:

– General cultural competencies: include knowledge and skills relating to general erudition, cultural and ethical norms, communication skills and social responsibility.

– Methodological competencies: covering knowledge of research methods, analysis and synthesis of information, critical thinking and a scientific approach to solving problems.

– Professionally oriented competencies: include specific knowledge and skills necessary to perform specific professional tasks, as well as adaptation to professional standards and norms.

This approach allows you to create a holistic system of training, which covers all aspects of the necessary knowledge and skills, thus providing effective preparation for professional activities.

General cultural competencies include the need for self-education and self-development, the moral positions of the individual and their manifestation in professional and pedagogical activities. They also cover holistic ideas about the human being, society, culture, science and technology in the modern world. In addition, these include the need and ability to maintain their physical and mental health, knowledge about maintaining performance in a rapidly changing life. It is important to be ready to use information and communication technologies in the educational process and the ability to creative activity.

Methodological competencies include the willingness to organize the educational process in an educational institution, to solve professional and pedagogical problems in conditions of uncertainty, to engage in innovative activities in their professional field. They also cover the ability to reflect, self-control and correct professional activities based on the results obtained.

Fig. 3. Professionogram of the teacher of practical training, electrical engineer[7]

Vocational-oriented competencies include readiness to prepare applicants for higher education to an appropriate level of qualification for working professions or positions of employees, as well as to develop content and didactic means of vocational training. They cover the ability to introduce modern technologies of professional training and education in the educational process. An important aspect is the readiness to plan and conduct classes using

[7] Васюченко П. В. Формування професійної компетентності з електротехніки у майбутніх викладачів електроенергетичних дисциплін: дис.… канд. пед. наук: 13.00.04. Чернігів, 2011. 231 с. – p.38

modern methods, organizational forms and means of training. Professionally oriented competencies also provide for the ability to compile lists of educational and production works, carry out their standardization, operation and maintenance of educational and production equipment, as well as draw up plans for educational work in groups. In addition, they include the willingness to organize extracurricular activities of students and use an individual approach in the education of higher education applicants.

Based on this, it is important to determine the limits of the ultimate goal in determining the trajectory of development of higher education applicants. This is achieved through an integrated approach that covers three interrelated areas of activity: educational, social and professional. The educational vector of the transition from educational activity through quasi-professional to professional activity sets the direction for the development of the competence of the future specialist, which is the ultimate goal of professional education.

Existing state educational standards in specialties for the most part contain requirements for the knowledge and skills of professionals, but do not cover their professionally important qualities and life orientations. Therefore, to implement the system of training graduates for professional activity and increase the motivation of students, a professionographic approach should be used.

Professionograms, as a system of requirements for a specialist, open up opportunities for predicting specific ways, methods, operations and criteria for the professional training of applicants for higher education. They allow not only to plan the learning process, but also to improve the personality formation programs of future specialists. Using professionograms, it is possible to identify the key competencies and skills necessary for successful professional activity, as well as develop individual development plans for each student. This allows us to provide a high level of professional training and adaptation to the requirements of the modern labor market. In addition, professionograms contribute to the formation of a comprehensive vision of professional development, taking into account both technical and socio-personal aspects of the specialist's activities.

3. Pedagogical conditions for the formation of electrical skills in students

Pedagogical conditions for the formation of electrical skills in students contain the following components:

1. Providing practice-oriented training, which includes laboratory and practical training, during which applicants for higher education can apply the knowledge gained in practice; the use of simulators and simulation environments that are as close as possible to the real working conditions of electrical engineering; organization of production practices on the basis of enterprises and organizations, where students can gain real experience.

2. Integration of modern technologies into the educational process is the use of modern software products for modeling and analysis of electrical systems; involvement of the latest technical means in the educational process, such as computer laboratories and interactive panels; use of information and communication technologies to create interactive educational materials and distance learning.

3. The creation of a stimulating learning environment includes the formation of a positive attitude of students towards learning through the use of motivational teaching methods; the use of game technologies to increase the interest of higher education applicants in the study of electrical engineering; organization of competitions, competitions and project works contributing to the development of creative abilities of applicants for higher education.

4. An individual approach to learning is the implementation of individual consultations and mentoring for students, taking into account their personal needs and level of training; developing individual curricula that allow students to work at their own pace and develop their strengths; the use of adaptive teaching methods that allow you to adjust the learning process in accordance with the progress of students.

5. Involvement of experienced specialists in the educational process includes lectures and master classes by leading specialists in the electrical engineering industry; organization of meetings and discussions with professionals with many years of experience in the industry; cooperation with enterprises and organizations to create internship and practice programs.

6. The development of critical thinking and problem-solving skills is the use of project-based learning methods that allow applicants for higher education to work on real tasks and projects; the use of problem-oriented learning, which encourages applicants for higher education to seek solutions to complex technical issues; organizing group discussions and debates to develop communication skills and teamwork skills.

The introduction of the above-mentioned pedagogical conditions for the formation of electrical skills in applicants for higher education allows for a high level of training. These conditions contribute to the development of not only technical knowledge and skills, but also the formation of personal and social competencies that are necessary for successful professional activity in the modern world.

Engaging in qualitatively different types of work and satisfying to a certain extent social needs, workers perform economically heterogeneous work. Socio-economic heterogeneity is manifested in the division of labor into mental and physical, complex and simple, self-organized and regulated, reproductive and productive.

Therefore, it is necessary to determine approaches to the formation of professional competence in electrical engineering for future specialists who

must have the necessary skills to perform certain functions in practical electrical engineering. This applies, in particular, to teachers of practical training in the field of electricity in the specialty A5 «Professional Education». The graduate receives the qualification «Bachelor of Professional Education (Energy, Electrical Engineering and Electromechanics)», while taking into account the double direction of his activity.

Formation of professional competence of students in electrical engineering occurs mainly within the educational process. The components of this process, including goals, content, principles and methods, forms, means and outcome, are considered as an integrated learning system. This system is a complex and dynamic process, which depends on the organic unity of interaction between the teacher and the student, as well as on the specifics of the professional activity of the future specialist.

Electrotechnical competence is the basis of technical training of a teacher of practical training in the field of electric power, who has a working profession of electrician.

The level of formation of professional competence in electrical engineering of a teacher of practical training in the field of electric power determines his ability to effectively adapt to changes in professional activity, and also contributes to a sense of confidence and security.

Electrical competence is considered as an integral part of the professional competence of a specialist in the field of electric power engineering. It consists of two main components: ideological and professional.

The worldview component includes a cognitive aspect, which involves the accumulation of knowledge and understanding of the basics of electrical engineering. The value-normative aspect reflects the moral and ethical norms associated with professional activity. Emotional-volitional component covers the ability to self-regulation, resistance to stressful situations and responsibility for the results of their work. The effective and practical aspect includes the application of the knowledge gained in practice, the ability to make informed decisions and solve professional problems.

The professional component covers specialized knowledge and skills required to perform specific tasks in the field of electrical engineering. This includes the ability to work with electrical equipment, compliance with technical standards and norms, as well as the ability to continuous professional development and improvement.

This comprehensive structure allows us to provide a high level of training of specialists capable of effectively fulfilling their professional duties and adapting to changes in the electric power industry.

The training of a modern electrician, a teacher of practical training in the field of electric power engineering, as well as the formation of his professional competence cannot be carried out in the conditions of traditional information and communication training. Today, a significant revision of previous approaches to the goals, content and methodology of training is necessary.

On the basis of psychological and pedagogical research, several key aspects can be attributed to the professional competence in electrical engineering of a teacher of practical training in the field of electric power engineering:

An idea of the role of the electrical industry in the country's economy and the prospects for its development – an understanding of the importance of the electrical industry for the national economy, its impact on other areas and importance for the innovative development of society.

Knowledge of methods of scientific research of electrical (technological) objects – mastering the methods of scientific research used to analyze, simulate and improve electrical systems and technologies.

Possession of a stable desire for self-improvement – the presence of motivation for constant self-development, including self-knowledge, self-control, self-esteem, self-regulation and self-improvement, the desire to improve their professional level through continuous learning and self-learning.

The desire for creative self-realization – the ability to find non-standard solutions and apply creativity in professional activities, the desire for innovation and experimentation.

Ability to system action in a professional situation – the ability to act systematically, analyze and design their own activities, make informed decisions in difficult and uncertain conditions, the ability to act independently and adapt in a rapidly changing environment.

Responsibility for the work performed – a high level of responsibility for their professional duties, the ability to effectively solve problems in the field of professional activity, the ability to work for the result, adhering to professional standards and ethical standards.

These aspects form the basis of professional competence of the teacher of practical training in the field of electric power, ensuring his preparedness for the challenges of modern professional activity.

Figure 4 shows the structure and content of professional competence in electrical engineering of a teacher of practical training in the field of electric power engineering and an electrical engineer, which is the result of a theoretical generalization of the analysis of pedagogical research and advanced practical experience.

In the process of practical activity of the teacher of practical training in the field of electric power and electricity, his level of professional competence in electrical engineering increases.

Based on the analysis of psychological and pedagogical literature, the following levels of professional competence in electrical engineering were determined: elementary-empirical (initial), reproductive, methodological, search, methodological (organizational and research).

1. Elementary-empirical (initial) level: this level is characterized by the fact that elementary information about electrical objects, phenomena and

processes accumulates without independent search and analysis, taken from a teacher or other applicant for higher education without critical understanding.

2. Reproductive level: this level is characterized by formal analysis and reproduction of cognitive and professional situations in the field of electrical engineering created by the teacher, where the student most often acts as a «spectator». The study of electrical engineering disciplines is based on previous knowledge and experience.

3. The methodological level is characterized by the analysis of educational and industrial electrical quantitative and qualitative tasks using generalized plans and samples. At this level, students are aware of the general guidelines of self-education. The reflection of the future dominates, as well as the ability to effectively solve production situations. Intellectual reflection allows students to actively participate in the management of their professional education and assist in the execution of demonstrations and laboratory work.

4. The search level is characterized by the fact that self-education becomes a familiar and natural part of life. The harmonious combination of reflection of past, present and future experience with creative, multi-role participation in solving real or simulated electrotechnical problems provides a gradual transition from joint activities of students and teachers to independent actions of students.

5 The methodological (organizational and research) level is characterized by the creative use of tasks and exercises in the context of the goal. This involves free and successful possession and the choice of all three roles depending on the educational situation. Self-education acquires a stable orientation, turning into a culture of thinking.

The transition of professional competence of students in electrical engineering from one level to another is associated with the development of intellectual skills from electrical engineering literacy to the corresponding electrical and technological culture. The complex of electrotechnical concepts of educational mandatory components, such as «Theoretical foundations of electrical engineering», contributes to the formation of the following components of the technological culture of the individual (Fig. 4):

– knowledge of historical aspects of technology and technology development;
– understanding the technical and technological aspects of the application of physical and chemical processes;
– ability to graphically depict the studied material objects and technological processes;
– knowledge of modern technologies in various areas of transformative activity;
– an idea of the main approaches to energy saving;
– conviction in the social significance of work and its role in the development of the individual and society;
– hard work, dedication and ability to complete started business;
– culture of human relationships;

– formed polytechnic and technological skills;

– knowledge of professional and psychophysiological requirements for a person in working conditions in various spheres of professional activity and the ability to make a conscious choice of the sphere of activity;

– ability to self-determination, self-knowledge, self-education and social realization.

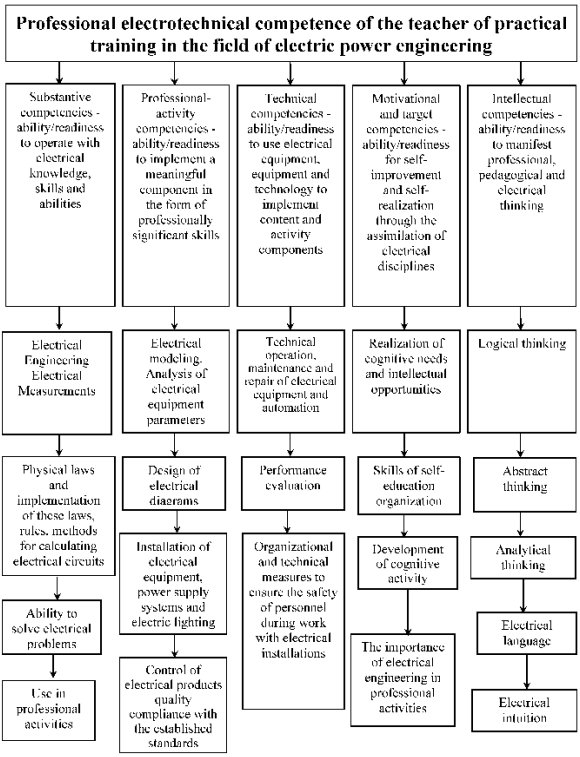

Fig. 4. Structure and content of professional competence in electrical engineering teacher practical training in the field of electric power[8]

CONCLUSIONS

The development of professional competence in electrical engineering is relevant for each student of the corresponding specialty. The formation of this competence is possible subject to the implementation of the principle of

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continuity and integrative communication between general education, general professional and special disciplines. Thus, continuity ensures the development of professional competence in electrical engineering by moving the most important elements to a new level for further improvement.

Conclusions on the formation of professional competencies of future specialists is an important aspect in the training of qualified specialists, as it contains the following topical issues:

– Integration of knowledge – a combination of general education, general professional and special disciplines is the basis for the integrated development of professional competencies. This allows students to acquire a wide range of knowledge necessary for their professional activities.

– Continuity – ensuring continuity in learning facilitates a gradual and systematic transition from elementary levels of knowledge to higher levels of professional competence. Continuity allows students to effectively learn new knowledge and skills, while maintaining the accumulated experience.

– Reflection and self-education – the development of reflection and self-education skills are important components of the formation of professional competence. Students have the ability to critically evaluate their experience, analyze it and apply new knowledge in professional activities.

– Practical application – the formation of professional competencies requires the practical application of theoretical knowledge. It is important to ensure that students are able to participate in real or simulated professional situations, which contributes to the development of skills and decision-making ability in specific settings.

Culture of thinking – the formation of a culture of thinking and awareness of the social significance of professional activity contributes to the development of responsibility, diligence and ability to self-improvement. This ensures stable development of professional competencies and adaptation to changing working conditions.

SUMMARY

The work considers the importance of the competence approach as the basis for the professional development of teachers. It is noted that the formation of competencies allows teachers to more effectively respond to modern challenges in the field of education.

It is emphasized that the systematic approach to the training of teachers of electrical engineering is based on the creation of a professionogram. This professionogram helps to determine the set of knowledge, skills and qualities necessary for the successful work of the teacher in this area.

The conditions that contribute to the formation of electrical skills are analyzed. In particular, we are talking about the importance of practical

training, the integration of modern technologies into the learning process and the creation of a motivating educational environment.

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