

риса, а також відповідність Стандарту вищої освіти другого (магістерського) рівня за спеціальністю 222 Медицина. Доведено, що більшість закладів вищої медичної освіти пропонують вибіркові курси, які формують окремі компоненти управлінської компетентності майбутнього лікаря в таких професійних сферах, як «співпраця», «послуги», «розвиток професії». Поза увагою розробників освітніх програм залишаються питання формування управлінської компетентності для здійснення власної професійної діяльності та професійного розвитку лікарів, сприяння розвитку професійної спільноти, удосконалення послуг, впровадження змін тощо. Зроблено висновок про наявність прогалів як в освітніх програмах, так і в знаннях студентів-медиків щодо необхідності оволодіння управлінськими знаннями, вміннями та навичками, а також застосування їх у професійній діяльності. Такі висновки дають підстави для розробки науково-методичних рекомендацій щодо вирішення цього питання.

Ключові слова: майбутній лікар, управлінська компетентність, освітня програма, Стандарт вищої освіти другого (магістерського) рівня, спеціальність 222 Медицина, основні курси, вибіркові курси, знання, вміння, навички.

УДК 37.091.12-051: 005.336.5/621.3

Liubov Yarosh

Institute of Vocational Education of the National Academy
of Educational Sciences of Ukraine
ORCID ID 0000-0002-7150-9053
DOI 10.24139/2312-5993/2023.08-09/314-324

A MODEL FOR THE SPECIALIST COMPETENCE FORMATION OF FUTURE ELECTRICAL TECHNICIANS IN AGRICULTURE COLLEGES

The article substantiates the relevance of the modelling method in educational research, specifies the initial principles of model construction and the sequence of operations in its development. The model for the specialist competence formation of future electrical technicians in agricultural colleges is presented.

The designed model consists of elements of a generalised nature, which can be considered as subsystems that are integrated from individual components. The interconnection of the system components and the integrity of the process of forming the specialist competence of future electrical technicians in agricultural colleges is ensured by relying on patterns, ideas and trends aimed at ensuring the integrity of the generalised components. The model includes methodological and target, subject, content, technological and diagnostic blocks. The goal and tasks of forming the specialist competence of future electrical technicians are implemented in three consecutive stages: information and motivational, formative and technological, and diagnostic and correctional.

Implementation of the model for the specialist competence formation of future electrical technicians in the educational process allows optimising the process of students' professional training, assessing the quality and dynamics of this process at certain stages of training, predicting and implementing adequate impacts in the educational environment.

Key words: model, modeling, specialist competence, future electrical technicians, agricultural colleges.

Introduction. In the context of innovative social and economic development of the country and high-tech production, employers' requirements for the content and quality of specialist training are growing significantly. The need to master and implement innovations, including high technologies, in professional activities, and fierce competition in the labour market require a graduate of a modern educational institution to possess a high level of professional competence, including specialist competence that ensures responsible use of knowledge and skills to solve scientific and production problems in the professional field.

Today's agricultural specialist is a person with broad general and specialised knowledge, able to respond quickly to changes in the agricultural market, with in-depth knowledge of innovations in equipment and technologies of any production. Continuous updating of knowledge and improvement of professional competences are important areas of the agricultural sector's workforce development.

The system of training highly skilled electrical technicians is currently undergoing major changes. The formation of a professional is inextricably linked to the formation of a holistic, humane, fully developed personality, as well as to the level of professional training provided in the system of secondary vocational education. It is quite obvious that the modern education system is developing in line with the formation of a market economy, informatisation of society, and the level of development of production technologies. A specialist must be able to create socially significant values, understand the content and purpose of his/her work, set professional goals and objectives independently, think through ways to achieve them, be able to choose, be capable of cooperation, be active, professionally mobile, be able to develop their knowledge, skills, abilities, be open-minded, tolerant, ethical. In these conditions, colleges of agriculture are called upon to conduct systematic work on the formation of specialist competence of students, future electrical technicians.

In the current situation, researchers note a growing trend towards the transition of pedagogy to a new quality – from descriptiveness to modelling and designing a new reality (personality, educational space, etc.), as there is an objective need to find a unified approach to the formation of professional competence of future specialists. It is about creating a kind of standardised system that will help manage the professional development trajectory of a specialist - a theoretical model of the formation of specialist competence of future electrical technicians.

One of the methods of scientific and educational research that is widely used today is modelling.

It has been proved that any modelling involves the use of abstraction and idealisation (this is especially true for modelling complex systems whose behaviour depends on a large number of interdependent factors of different nature). In this regard, the most difficult task is to choose an adequate formative parameter for determining the degree of objective conformity.

Analysis of current research. In educational science, the method of modelling is substantiated in the works of M. Anisimov, Sh. Amonashvili, N. Briukhanova, A. Yerina, M. Kademiia, E. Kozlovskiy, N. Koroliova, H. Kravtsov, Ye. Lodatko, S. Arkhangelskiy, S. Batyshev, I. Osadchyi, and others.

The model reflects: the requirements of the state, society, employer and individual to the process of forming the specialist competence of future electrical technicians in agriculture colleges; organisation of a holistic process of competence assessment in the system of professional training of future electrical technicians. The basis for building a system for the formation of specialist competence of future electrical technicians is the modelling method – reproduction of the study object characteristics as another, specifically created object – a model. M. Tiutiunyk interprets modelling as the process of creating a hierarchy of models, in which some real-world system is modelled in different aspects and by different means" (Тютюнник, 2012).

The main concept of the modelling method is the model. According to Ye. Lodatko, the general scientific concepts of "model" and "modelling" have "features whose nature is based on the vagueness and blurring of educational concepts" (Лодатко, 2010). A model is an artificially created object in the form of an image, diagram, description, physical structures, symbolic forms, etc., which, similar to the object under study, is used as a "substitute" and reflects in a simpler form the structure, properties, interconnections and relationships between the elements of this object.

In educational modelling, structural-functional models are most often in demand, in the construction of which the object is considered as an integral system, including components, elements, subsystems. The components of the system are connected by structural relationships that reflect the subordination, logical and temporal sequence of solving individual tasks.

The analysis of the educational modelling principles in various educational fields based on the works of A. Yerina, M. Kademiia, E. Kozlovskiy, H. Kravtsov, Ye. Lodatko, S. Arkhangelskiy, A. Dakhin and

other scholars allows us to identify the conceptual provisions used in modelling various educational objects:

- introduction to the problem of model design and determination of the modelled object's function, its place and role in the education system;
- developing a component system of the investigated object's structure that has maximum functional completeness (defining the criteria for functional completeness, conducting control measures to verify the functional completeness of these structural components);
- determining the previously identified components of the minimum acceptable set of basic system components; establishing interconnections (logical, functional, semantic, technological, etc.) of the system components;
- designing a model of the research object's dynamics.

The processes of design and modelling are most often associated with the need to analyse educational processes, improve and modernise them; test certain new approaches to education; intensify innovative processes that ensure the development of the education system and its components, etc. Based on the theoretical problem analysis of educational modelling, we have clarified the sequence of operations in model design as follows: defining the purpose and objectives of modelling; collecting, systematising and processing information related to the formulated objectives; identifying the main factors that have a significant impact on the object or phenomenon under study; model design; transforming the model in relation to specific, fixed pedagogical conditions, taking into account the identified essential factors, selecting the best options for the results obtained; developing a set of recommendations for changing the pedagogical object at the final stage of modelling (the stage of transferring the result to the object).

Based on the theoretical analysis of the scientific literature on the problems of forming the specialist competence of future electrical technicians, the content of their professional activity, and the results of the ascertaining stage of the experiment, we have developed a model for the formation of specialist competence of future electrical technicians in agricultural colleges (Fig. 1). In the process of developing the theoretical model, we distinguish the following blocks: methodological and target, subjective, content and technological, and diagnostic and resultant.

The methodological and target block is the theoretical and methodological basis for the formation of specialist competence of future electrical technicians and determines the content of all other blocks of the

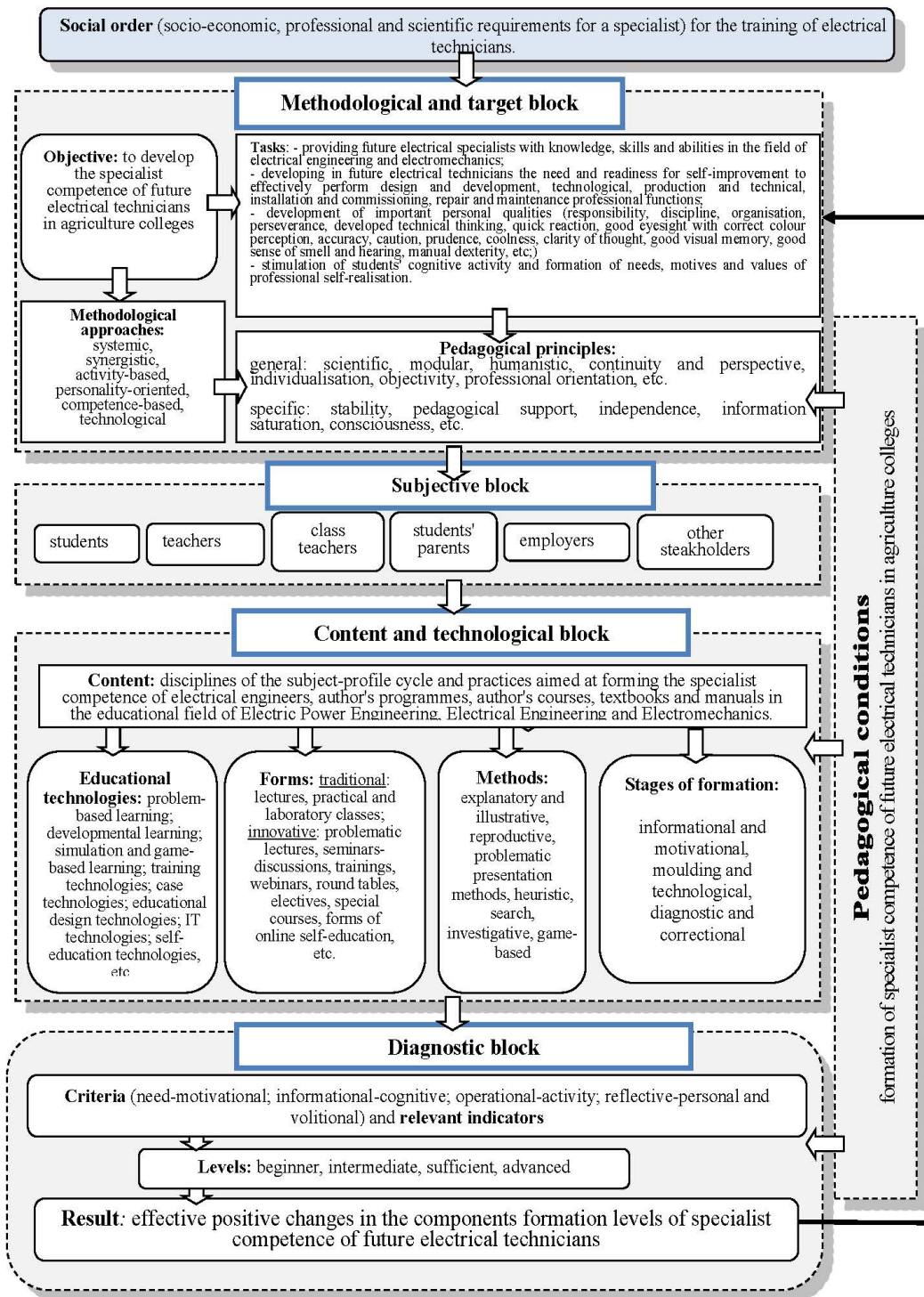


Fig. 1. Model of formation of specialist competence of future electrical technicians in agriculture colleges (compiled by the author)

developed model, it includes the goal: to form specialist competence of future electrical technicians. To achieve this goal, it is necessary to solve the following tasks:

- equipping future electrical technicians with knowledge, skills and abilities in the field of electrical engineering and electromechanics;
- developing in future electrical technicians the need and readiness for self-improvement to effectively perform design and development, technological, production and technical, installation and commissioning, repair and maintenance professional functions;
- development of important personal qualities (responsibility, discipline, organisation, perseverance, developed technical thinking, quick reaction, good eyesight with correct colour perception, accuracy, caution, prudence, coolness, clarity of thought, good visual memory, good sense of smell and hearing, manual dexterity, etc;)
- stimulation of students' cognitive activity and formation of needs, motives and values of professional self-realisation.

We have identified the following methodological approaches as the basis for developing the theoretical model: systemic, activity-based, synergistic, competence-based, personality-oriented, and technological.

The priority is the systemic approach, which allows us to identify and analyse the structural components of the model we have developed as an integral system consisting of multi-level components that are in various relationships. The main idea of the competence-based approach is that the main result of education is not individual knowledge, skills and abilities, but the ability and readiness of the student to work effectively and efficiently in various professional situations (Теоретичні і методичні засади моделювання фахової компетентності керівників закладів освіти, 2010). This approach focuses the education system on ensuring the quality of training in line with the needs of modern society. The systemic approach dictates the need to consider the process of forming the specialist competence of future electrical technicians as a system, an integral complex of interrelated elements, headed by a goal, or rather, a taxonomy of goals that sets it, since "in a social system, the goal is one of the leading systemic factors" (Чернілевський, 2010, p. 51).

The idea behind the activity-based approach is that new knowledge is not given in a ready-made form. Students learn it on their own in the process of learning activities. When teaching new material, the teacher's task is not to explain, show and tell everything clearly and easily, but to

organise the work of students in such a way that they themselves can come to a solution to the task and explain how to act in certain situations and conditions (Теоретичні і методичні засади моделювання фахової компетентності керівників закладів освіти, 2010).

The competence-based approach is inextricably linked to the idea of a comprehensively trained and educated personality, and aims to graduate not only specialists but also professionals in their field, who should be individuals while remaining members of the team and society. Therefore, the idea of the approach is not only to impart to the student a set of knowledge and skills determined by the potential field of activity, but also to "develop a worldview, interdisciplinary flair, the ability to make individual creative decisions, to self-learn, and to form humanistic values" (Брюханова, 2007).

The personality-oriented approach is considered to be the most "tuned" to the individualisation of the educational process, which is why some researchers perceive it not just as an "approach" but as a "paradigm" of vocational education: "This paradigm of education is the most adequate to the philosophy of open education. It implies both education and self-education, development and self-development and self-actualisation of the individual. Focused on the individual psychological characteristics of the personality, education should be inherently variable, representing the possibility of free choice of educational routes" (Caspari, Grünewald, Hu, Küster, Nold, Vollmer, Zydatiņ, 2008).

From the standpoint of the synergistic approach, education is considered as a complex, open, non-equilibrium and non-linear system that proves different types of self-organisation. The implementation of the synergistic approach in the formation of specialist competence of future electrical technicians in agriculture colleges is manifested in the renewal of educational content, organisational forms, methods and technologies.

The effectiveness of the above approaches depends on the full implementation of their respective theoretical assumptions, requirements of both general (scientific, modular, humanistic, continuity and perspective, individualisation, objectivity, professional orientation, fundamental nature of education, etc.) and specific (stability, pedagogical support, independence, information saturation, consciousness) principles.

An important issue related to the theory and practice of educational modelling is the problem of considering a person as a component of the educational system. Educational interaction is characterised by subject orientation and is provided by the subjects of the educational process. In the

model of forming the specialist competence of future electrical technicians in agricultural colleges, the subject-subject relationships between the participants of the educational process involved in the professional training of future electrical technicians define the subject block: teachers, students, class teachers, students' parents, employers, and other stakeholders.

The content and technological block of the model reflects the pedagogical conditions, stages, methods and means of forming the components of specialist competence of future electrical technicians in agriculture colleges.

In this article, the specialist competence of an electrical technician is considered as a construct of five interdependent components: motivational, cognitive, activity, personal reflexive and emotional-volitional.

A component of the model for the formation of specialist competence of future electrical technicians is a set of pedagogical conditions that contribute to the effectiveness of professional training in colleges of agriculture. It is substantiated that such circumstances are: selection and structuring of the content of the disciplines' working curricula in accordance with the learning outcomes declared in the educational standards; targeted development of students' critical thinking and the ability of future electrical technicians to creatively solve problems in the calculation, design and operation of electrical equipment; introduction of a training organisation system, which combines pedagogically appropriate information-reproductive and problem-search models of pedagogical interaction; dominance of contextual learning technologies, simulation modelling in the professional training of electrical technicians; objective assessment of the quality of training of electrical technicians at all stages of mastering the educational and professional programme.

Practice has shown that the process of forming the specialist competence of future electrical technicians in agriculture colleges is a complex process, so we traced its implementation through three stages: information and motivational, formative and technological, and diagnostic and corrective.

The content and technological block presents methodological mechanisms for coordinating the process of professional training of future electrical technicians in agriculture colleges, namely the following educational technologies: problem-based learning; developmental learning; simulation and game-based learning; training technologies; case technologies; educational design technologies; IT technologies; technologies

of self-education, etc., as well as methods (explanatory and illustrative, reproductive, problem-based, heuristic, search, research, game) and forms: problematic lectures, seminars-discussions, trainings, webinars, round tables, electives, special courses, forms of Internet self-education, etc., the functional purpose of which is to transform the knowledge component of specialist competence into conscious and effective production activity.

The final component of the presented model is the diagnostic and resultant block, which reflects the effectiveness of the process of forming the specialist competence of future electrical technicians in agriculture colleges and characterises the achieved results of professional training in accordance with the set goals. This block includes criteria, levels, indicators of graduates' specialist competence.

The level of specialist competence is assessed by means of need-motivational, informational-cognitive, operational-activity, reflective-personal and volitional criteria that correspond to the structural components of professional competence. In accordance with these criteria, the main indicators were established. The result of the formation of the components of professional competence of future electrical technicians in agriculture colleges was determined by initial, medium, sufficient and high levels.

The levels of its formation in terms of content are presented as follows:

Beginner level is characterised by low (or no) motivation for educational research activities; low interest in the work performed, accompanied by negative emotions; lack of self-confidence and positive results. Students have superficial knowledge and do not realise its importance and need for further education and professional growth. Future specialists completely lack leadership skills, perseverance in the performance of work, the desire to organise themselves and others for successful activities, "original" ideas, objectivity in self-analysis of activities; they need constant assistance from the teacher.

Sufficient level is characterised by possession of a sufficient level of knowledge, professional skills and abilities in conducting an experiment, awareness of the actions performed. The last ones are willingly involved in exploratory research activities, but do not go beyond them; have a sufficient degree of self-confidence, a sufficient level of activity in solving collective tasks; insufficiently expressed ability to reflect.

Advanced level is characterised by a pronounced intrinsic motivation for educational and professional activities; a strong search and cognitive interest; a high degree of self-confidence in one's abilities to perform tasks. Students have a broad outlook that goes beyond the scope of the speciality; deep and systematic knowledge in the electrical engineering field, an advanced level of comprehension of the acquired knowledge; the ability to transfer their skills to solve problems and use them in other disciplines. Future electrical technicians are characterised by reference groups of personal qualities; the ability to see their own mistakes and suggest ways to correct them.

The diagnostic and resultant block of the developed model reflects the effectiveness of the formation of specialist competence of future electrical technicians in agriculture colleges, which is determined by the correlation of the results obtained with the goals set.

Conclusion. Based on the above, the following conclusions can be drawn: modern conditions put forward new requirements for the quality of training of technical specialists. Society needs a new class of technicians who have a set of specific abilities, qualities and personality traits that allow them to effectively solve professional problems in typical and non-standard situations, and to evaluate the results of their work. At the same time, the content of educational programmes and the educational technologies used today usually do not allow graduates to fully develop these indicators.

To resolve this contradiction, the author has developed a model for the formation of specialist competence of future electrical technicians in agriculture colleges. Its implementation in the educational process allows to optimise the process of professional training of students, to assess the quality and dynamics of this process at certain stages of training, to predict and implement adequate impacts in the educational environment.

REFERENCES

- Брюханова, Н. О. (2007). Підходи до розуміння компетентності та компетенції в освіті. *Педагогіка і психологія професійної освіти*, 4, 40–51 (Briukhanova, N. O. (2007). Approaches to understanding competence and competence in education. *Pedagogy and psychology of professional education*, 4, 40–51).
- Лодатко, Є. О. (2010). Моделювання в педагогіці: точки відліку. *Педагогічна наука: історія, теорія, практика, тенденції розвитку*, 1. URL: http://intellect-invest.org.ua/pedagog_editions_e-magazine (Lodatko, E. O. (2010). Modeling in pedagogy: counting points *Pedagogical science: history, theory, practice, development trends*, 1. URL: http://intellect-invest.org.ua/pedagog_editions_e-magazine).
- Підлісний, Є. (2018). Модель формування правової культури бакалаврів економіки. *Молодь і ринок*, 11, 148-154 (Pidlisnyi, E. (2018). Model of

formation of legal culture of bachelors of economics. *Youth and the market*, 11, 148-154).

Теоретичні і методичні засади моделювання фахової компетентності керівників закладів освіти (2010). Г. В. Єльнікова (ред.). К., Чернівці: Книги–XXI. (*Theoretical and methodological principles of modeling the professional competence of heads of educational institutions* (2010). H.V. Yelnikova (ed.). K., Chernivtsi: Books–XXI).

Тютюнник, М. (2012). Теоретичні аспекти моделювання як методу наукового дослідження. *Педагогічні науки*, 96. (Tyutyunnyk, M. (2012). Theoretical aspects of modeling as a method of scientific research. *Pedagogical Sciences*, 96)

Чернілевський, Д.В. (2010). *Методологія наукової діяльності*. Вінниця: Вид-во АМСКП (Chernilevsky, D.V. (2010). *Methodology of scientific activity*. Vinnytsia: Publishing house of AMSKP).

Caspari, D., Grünewald, A., Hu, A., Küster, L., Nold, G., Vollmer, H. J., & Zydatis, W. (2008). *Kompetenzorientierung, Bildungsstandards und fremdsprachliches Lernen—Herausforderungen an die Fremdsprachenforschung. Positionspapier von Vorstand und Beirat der DGFF*. Retrieved URL: http://orbilu.uni.lu/bitstream/10993/11606/1/Kompetenzpapier_DGFF.pdf

f

АНОТАЦІЯ

Ярош Любов. Модель формування фахової компетентності майбутніх техніків-електриків у коледжах аграрного профілю.

У статті обґрунтовано актуальність методу моделювання у педагогічних дослідженнях, уточнено вихідні принципи побудови моделі та послідовність операцій при її розробці. Представлена модель формування фахової компетентності майбутніх техніків-електриків у коледжах аграрного профілю.

Спроектвана модель складається зі елементів узагальненого характеру, які у самотійному вигляді можуть розглядатися як підсистеми, що інтегруються з окремих складових. Взаємозв'язок компонентів системи і цілісність процесу формування фахової компетентності майбутніх техніків-електриків у коледжах аграрного профілю забезпечується опорою на закономірності, ідеї та тенденції, спрямовані на забезпечення цілісності узагальнених компонентів. Модель включає методологічно-цільовий, суб'єктний, змістовно-технологічний та діагностичний блоки. Реалізація мети та завдань формування фахової компетентності майбутніх техніків-електриків здійснюється протягом трьох послідовних етапів: інформаційно-мотиваційного, формувально-технологічного й діагностико-корекційного.

Впровадження моделі формування фахової компетентності майбутніх техніків-електриків в освітній процес дозволяє оптимізувати процес професійної підготовки студентів, оцінювати на певних етапах навчання якість та динаміку цього процесу, прогнозувати та здійснювати адекватні впливи в освітньому середовищі.

Ключові слова: модель, моделювання, фахова компетентність, майбутні техніки-електрики, коледжі аграрного профілю.