European Vector of Modern Education, Science and Production – 2024

Series of monographs
Slovak Publishing House
NES Nová Dubnica s.r.o.
Monograph 2

Publishing House NES Nová Dubnica s.r.o., 2024

Series of monographs Slovak Publishing House NES Nová Dubnica s.r.o., Slovenská Republika

Monograph 2

ISBN 988 – 963 – 8454 – 15 – 3 - 3S

Editorial compilation
Publishing House NES Nová Dubnica s.r.o.
M.Gorkého 820/27, P.O.BOX
018 51 Nová Dubnica, Slovenská Republika
tel. +421-42-4401 209

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3.1. Formation of Graphic Competence in Students of Energy Specialties

The changes taking place in modern Ukraine require a qualitative transformation of the content of education, an increase in the level of competitiveness of university graduates for various spheres of industrial activity. But in recent years, when applicants are accepted based on the results of the National Multi-Subject Test, the development of graphic competence has decreased sharply. Many students practically do not have the skills of building and reading drawings and do not realize the need for independent actions through self-organization and self-control. In our opinion, the main reason is the decrease (or lack) of hours devoted to studying drawing at school, insufficiently developed skills of regular work to acquire knowledge, lack of interest in self-education, and the infantilism of some students.

Many school graduates have a low level of development of spatial thinking. Testing in recent years shows that when solving stereometric problems for pyramids and round bodies, only a third of students cope with solving a geometric problem, and school graduates on a multi-subject test either solve only planar problems or do not perform geometric problems at all. One of the reasons for the current situation is that the developed stereotype of work on the plane does not allow to adequately reproduce the drawing of the spatial body.

All of the above reasons give rise to the first-year student's fear of these graphic disciplines, often unwillingness to study sketch geometry, engineering and computer graphics, design and modeling of technical objects.

The research conducted over three years showed that the residual level of basic training of school graduates is very low. 30% of first-year students know how to correctly arrange views, approximately 15% build views in a projection connection with compliance with the required dimensions, 35% know how to make a visual representation, 12% know how to divide a circle into five or six parts. A very small percentage (5%) knows and uses the types of lines as intended.

Graphic disciplines, which are traditionally studied at Berdyansk State Pedagogical University in the first and second semesters, contribute to the formation of students' graphic and professional competence, the basis of knowledge and skills necessary for the successful mastering of the hereditary disciplines of the energy profile, which are studied in the following semesters. This knowledge is important when working on the graphic part of the course project, studying the theory of machines and mechanisms, hydraulics, heat engineering, special disciplines.

To the concept of "graphical competence" of a future specialist in the energy environment, we refer to a set of qualification and professional-personal orientations of consciousness and behavior that ensure the readiness to apply knowledge, skills and personal qualities for successful geometric and integrative modeling, as well as graphic presentation of engineering objects. We consider the development of graphic

competence of students at any level of their training in graphic disciplines as a process of step-by-step theoretical development and practical consolidation of norms, rules and methods of creation, analysis of the graphic nature of engineering objects, imaginary reproduction of graphic objects and operation of graphic images in in the course of practical solutions.

The study of graphic disciplines forms the intellectual sphere of an engineer and his readiness for professional design and construction activities. In order to identify the difficulties that first-year students have regarding sketch geometry and engineering graphics, we used such methods as questionnaires, tests, control works to determine residual knowledge, and oral surveys of students. The students attributed the following factors to the difficulties in studying graphic disciplines: the content of the subject, sketch geometry, a very high level of abstraction, undeveloped spatial thinking, a low level of school preparation, the complexity of textbooks in the discipline, irregularity of classes.

Teachers are forced to look for new forms and methods of teaching in order to quickly raise the level of first-year students to the norms established at the university. The formation of graphic competence among university students entails the solution of such tasks as:

– awareness and understanding of the importance of graphic training for solving specific educational and professional tasks;

– formation of readiness to carry out professional activity, realizing the graphic potential acquired in it;

– the formation of a technical type of thinking, which basically involves well-developed spatial thinking, which determines the creative potential of the future technical specialist;

– formation of a motivational and value attitude towards the need to develop professional and personal qualities and abilities by means of graphic training;

– possession of the required amount of design and graphic knowledge, abilities and skills, taken in unity and interaction with a professional engineering and design orientation;

– development of general educational (generalized) skills - managerial (goal setting, planning, control and analysis), informational (finding, processing and use of information), logical (structuring the content of the educational process, setting and solving educational tasks), communicative (making various contacts between participants joint activity).

Students with a low level of preparation in graphic disciplines can be divided into several groups:

– students who do not attend classes - there is no motivation to study at the university. Most of the time, they are deducted from the results of the session, if they do not make efforts to acquire knowledge;

– students who want to learn new material, but do not have the ability (for example, not developed spatial thinking, no drawing skills due to lack of school

training). The work of teachers with such students brings little success, but makes it possible to pass exams and tests satisfactorily;

– students who have abilities, but do not want to develop them. The teacher's task in the cases is to develop the motivation to study graphics, the interest of such students in learning new material;

– students who do not consider themselves poorly prepared, painfully react to low grades, beg for an "extra point". The opportunity to find contact between teachers and such students consists in additional classes, tasks, involvement in participation in conferences, writing essays, etc.;

– students who critically evaluate their level and wish to improve their learning results. Their level undoubtedly increases during the semester. It is easy for teachers to find contact with such students, for them it is enough to conduct consultations to indicate problems and ways to solve them.

When working with students with a low level of preparation, it is necessary to encourage any self-made work, conduct conversations, and increase motivation to study graphics. The positive role of graphic professional tasks should be emphasized. Practice shows that in those groups where students connect their educational activities with production, with specific professional tasks, students who have little time are highly motivated to study the subject, thereby allowing them to "bring up" their knowledge to the average in one semester equal.

Having analyzed the problems related to the formation of graphic competence among students with a low level of graphic training, we came to the conclusion that if students have certain abilities and positive motivation for learning graphics, the organized independent work of students plays a decisive role. A person's abilities are judged not by what he can do on the basis of imitation, learn as a result of a detailed, detailed explanation, when knowledge is presented to him in a "ready-made" form. The mind of a person, his abilities are revealed in relation to independent acquisition, discovery of new knowledge, in the breadth of transferring this knowledge to a new situation, while solving non-standard, new tasks for him.

The main tasks that must be solved during the solution of this problem: the organization of the student's independent work; increasing motivation to acquire new knowledge in the discipline, regardless of the level of his preparation, by maximally revealing his potential; stimulation of the perceived need for independent work; carrying out a systematic assessment of the student's achievements and carrying out adjustments of further actions with the help of teachers.

At present, developed didactic materials and recommendations for teachers of graphics departments are being prepared. Specially selected tasks of different levels stimulate mental activity, which supports interest, and the "discovery" made by the student brings them emotional satisfaction and is much more firmly fixed in the memory than knowledge presented in ready form. In the process of solving specific graphic tasks, students overcome emerging contradictions between existing knowledge and the requirements of the task, discover new elements of knowledge, new ways of operating with them, master methods of cognition, which expands their ability to solve new, even more complex problems. This active independent mental activity leads to the

formation of new connections, new personality properties, positive qualities of the mind and thereby to a shift in mental development.

The main emphasis in this methodology is on the development of interest in the study of sketch geometry, spatial thinking and geometric intuition, taking into account the professional interests of future technical specialists. The subject is adapted for each student, he receives a maximum of information, practical classes become clearer for students.

The effectiveness of teachers' work with underachieving students is measured by the level achieved by their ability to solve tasks: they are able to see a problem, move from guesses to analyzing the situation, from analysis to setting a problem and solving it, which allows you to quickly, deeply and correctly navigate the algorithm of solutions graphic and professional tasks

It should be noted that the teacher's role increases when working with low-achieving students. The effectiveness of classes is largely determined by the skill of the teacher, his influence on students, and the quality of preparation for classes. He needs deep knowledge of the scientific foundations of drawing, extensive familiarity with special literature on the subject, solid knowledge of standards. The teacher must know the history of the development of graphics and be aware of the latest achievements. All this will give the teacher the opportunity to feel confident in the lesson, to deeply cover the theory of the subject, to find interesting and convincing examples that are as close as possible to the future professional activity.

In order to be an example for students in everything, a graphics teacher must perfectly master the skills of drawing and sketching on a blackboard, possess modern graphic packages of automated design programs.

A major role is played by the language of the teacher, which should be grammatically correct, short, clear and logical. The correct language of the teacher not only contributes to a better understanding of the educational material, the development of special concepts and professional terms, but also serves as a model for students.

Special attention should be paid to the pace of speech. Sometimes teachers speak too quickly, using complex terms. This has a harmful effect on the assimilation of the material, students do not catch the meaning of what is said, do not have time to build drawings according to the teacher, begin to violate discipline.

The correct behavior of the teacher contributes to the creation of a good psychological climate, which in turn contributes to the achievement of high results in education.

Thus, when working with students with a low level of training in graphic disciplines, it is necessary to actively use modern methodological techniques, increase pedagogical skills, apply interactive teaching methods, properly organize independent work of students, as well as make wider use of information resources and work with computers (use graphics programs), to organize additional classes for low-achieving students.

3.2. Model for Designing Multilevel Competence-oriented Evaluation Tools for the Formation of Graphic Competence in Students of Energy Majors

One of the most important components of the professional competence of a graduate of the energy specialty is engineering and graphic competence, which we consider as a set of qualification and professional and personal characteristics: knowledge, skills, abilities that ensure successful modeling and graphic representation of engineering objects [3]. The diagnosis of the level of development of engineering-graphic competence and its individual components requires the creation of multi-level evaluation tools of various forms and levels of complexity related to the tasks of the professional activity of the future engineer (in our case, the engineer-pedagogue).

We have developed a model for designing such tools, which includes three blocks.

The organizational-purpose block reflects the unified goals and tasks of design, as well as its theoretical and methodological basis, represented by the main provisions of modern didactics, quality metrics, testology and normative and legal documents in the field of education. The didactic aspect of design takes into account modern requirements regarding the quality of engineering and graphic training of a graduate

The theoretical analysis of scientific publications showed that the main criteria for the quality of engineering and graphic training today are its fundamentality, professional orientation, problem-oriented and anticipatory character.

The fundamentality of engineering and graphic training of future engineer-pedagogues involves the formation in them of a system of invariant methodologically important engineering and graphic competencies that allow them to adapt in the field of energy and be competitive in labor markets.

The anticipatory nature of the preparation involves a certain didactic rhythm of teaching and learning the educational material according to engineering graphics, in which the "springboard" of the next topic is captured in the process of studying the previous topic. At the same time, the content of engineering and graphic training should not lag behind the scientific and technical progress in the field of energy, which is implemented in two main directions: the introduction of regulatory documents reflecting the rules for marking and depicting electrical circuits and structures; optimization of the process of creating flat drawings and three-dimensional models due to the improvement of graphic software packages.

The professional orientation of engineering and graphic training involves the use of pedagogical tools that create the conditions for maximum approximation to future professional activity. Employers, university graduates, teachers of related disciplines, etc. should be involved in assessing the level of development of students' competencies as external experts.

The problem-oriented nature of the training involves searching educational and research activities of students using information technologies, aimed at mastering methods of solving problem situations that correspond to current problems of science and practice in the field of construction [3].

It is obvious that the competency-oriented assessment tools being designed should provide the possibility of establishing the compliance of the quality of engineering and graphic training with the criteria discussed above. The study showed that solving this

task requires taking into account a number of principles in the process of designing such tools: student-centeredness, diagnostic, interactivity and multifunctionality.

The principle of student-centeredness involves shifting the emphasis from the learning process to its results and the students' acquisition of relevant competencies, the multi-level diagnosis of which should be the focus of the evaluation tools being developed.

The principle of diagnostic requires the ability to measure (with the help of designed evaluation tools) the level of formation of both integral engineering and graphic competence and its individual components and provides for the systematicity and systematicity of diagnostics (input, intermediate, final diagnostics).

The principle of interactivity involves the organization of the process of active diagnosis, which involves interpersonal communication of students with the teacher and with each other for the purpose of correction, control, self-control and mutual control of the work performed, as well as making an assessment, self-assessment and mutual assessment. Mutual review, mastery, evaluation of works and projects allows students to exchange experience of educational activity, promotes its reflection and development of professionally important personality qualities of the future specialist.

And, finally, the principle of multi-functionality of evaluation tools provides for their comprehensive implementation of diagnostic functions: prognostic (obtaining anticipatory information for the formation of engineering and graphic competence); diagnostic (combination of assessment tools of various types that allow diagnosing the level of formation of individual competencies and their integrated set); modeling (assessment tools should simulate the corrective action in a timely manner); analytical (analysis of student achievements and identification of ways of their further development and correction).

The implementation of the considered principles is possible when using in the process of designing assessment tools a number of approaches that complement each other: qualitative, competence, thesaurus and taxonomic, presented in the technological block of the model.

The qualitative approach, which involves the application of the method of group expert evaluations, was used to identify the structure, content, and levels of formation of students' engineering and graphic competence, as well as to obtain a quantitative assessment of the quality of the multi-level assessment tools being developed. [4].

The structure of engineering and graphic competence identified by us is represented by groups of general cultural and professional competences and their subgroups. General cultural competences include subgroups of organizational and regulatory ones. The first includes competencies that include: mastery of abstract thinking skills (thinking with abstractions: intersecting planes, sections, etc.); ability to continuous training and retraining, etc. In turn, regulatory competencies include understanding the role of regulatory legal documents in the energy industry, the ability to use standards and reference literature. Professional engineering and graphic competencies are represented by subgroups of analytical, graphic, project and information [3]. For example, graphic competencies include mastery of drawing skills;

the ability to perform geometric constructions; the ability to perform orthogonal projections of details, etc.

To move from the structure to the content of engineering and graphic training, a thesaurus approach was used, which involves a compact representation of hierarchically interconnected competencies that are diagnosed, and their corresponding educational elements (descriptors) [2], which form an integrative competency-oriented thesaurus of the discipline. Based on it, a thesaurus of evaluation tools was developed, which includes 320 descriptors (dimensional number, standard size, etc.).

The taxonomic model proposed by the experts is represented by the basic, programmatic and creative levels of the formation of engineering and graphic competence.

The basic level requires knowledge of the conceptual and terminological apparatus of engineering graphics and structural features of devices and mechanisms used in construction; the ability to design similar structures, as well as to apply properties, theorems and typical algorithms when solving graphic problems.

This level corresponds to the categories of knowledge, understanding and application in standard situations. The student not only explains the terms, methods and rules of engineering graphics, transforms verbal material into graphic material, but also presumably describes the possible consequences of their illiterate use. The basic level is controlled by heterogeneous standardized tests aimed at identifying various factors (knowledge, skills, abilities [3]) and measuring the level of preparedness in several sections of the discipline. They include criterion- and normative-oriented parts. The criterion-oriented part is a system of tasks that measures the level of educational achievements in relation to the full scope of knowledge, skills, and abilities that must be mastered by students and presented in the thesaurus of assessment tools. The norm-oriented part ranks students according to their level of preparation.

The program level corresponds to the categories of application in new situations, analysis and synthesis. The student must be able to analyze various constructions of construction products, choosing the most optimal one of them, making the necessary changes aimed at its improvement. This level involves the application of laws, theoretical conclusions in specific practical situations; the use of concepts and principles of image construction in new situations (for example, during the execution of drawings in graphic editors KOMPAS and others.), and even the isolation of parts of the whole drawing, identifying the relationship between them; finding errors and omissions in drawings; assessment of the significance and completeness of the initial data for their implementation.

For the diagnosis of this level, it is suggested to use calculation and graphic tasks, mini-graphic, individual graphic and multifunctional tasks. In computational and graphic tasks, attention is focused on the computational part of image construction. In minigraphics - on sketch images of the necessary products and structures in order to develop students' graphic competences. Individual graphic tasks require careful processing of drawings, which are performed as part of independent work and involve the teacher's consultation. Multifunctional tasks are related to the future professional activities of bachelors and require the manifestation of integral engineering and graphic competence.

The creative level, to which the assessment and forecast categories correspond, involves the student's ability to solve problematic professionally oriented tasks, independently develop drawings of original constructions of construction devices, predict potential opportunities for their use and improvement [3]. A student's engineering and graphic competence is formed at a creative level, if he participates in Olympiads, improves his training in the field of computer modeling and other types of activities that contribute to the development of creative professional competences.

For a multi-faceted assessment of the quality of engineering and graphic training at the final diagnosis stage, it is advisable to use complex situational tasks. They combine a heterogeneous test, computational and graphic tasks and multifunctional tasks related to one professional situation. The completeness and correctness of the task determine the degree of resolution of the given situation and testify to the level of development of engineering and graphic competence of the undergraduate student.

All developed assessment tools are presented in the distance course "Engineering and computer graphics", which can be accessed from a computer, laptop or tablet at any time convenient for students.

The assessment stage of the technological block of the model involves determining the quality of the developed assessment tools, as well as their correction, approval and further introduction into the educational process [5].

The quality of evaluation tools was determined according to the established method of group expert evaluations by the following criteria: "Fundamentality" (F), "Anticipatory and problematic nature" (P), "Professional orientation" (S).

The first criterion characterizes the completeness of the display in the set of evaluation tools of the system of invariant methodologically important competencies and is calculated according to the formula:

$$F = NKT/N,$$

where N – is the number of all tasks;
NKT – the number of tasks that diagnose the criterion-oriented part of the thesaurus (determined by the method of group expert evaluations and includes descriptors detailing invariant competencies).

The criterion "Anticipatory and problematic nature" reflects the share of tasks of an anticipatory and problematic nature in the set of evaluation tools and is determined by the formula:

$$P = NP/N,$$

where Np – is the number of tasks of this nature.

The criterion "Professional orientation" characterizes the orientation of evaluation tools to the profile of the direction of training and is calculated according to the formula:

$$S = NS/N,$$

where NS is the number of professionally oriented tasks.

The comprehensive assessment of the quality of the developed tasks was determined by the formula:

$$K = C1 \cdot F + C2 \cdot P + C3 \cdot S,$$

where C1 = 0.5; C2 = C3 = 0.25 – coefficients determined by ranking the criteria ($\sum C = 1$).

And, finally, the diagnostic block of the model characterizes the result of the design process - a set of qualitatively based multi-level assessment tools for engineering graphics for undergraduate students. In addition, we highlight a social result that involves not only improving the quality of diagnostics of engineering and graphic training, but also a universal technology for designing assessment tools that can be used at all levels of education and is aimed at improving the quality of diagnostics of engineering and graphic competence.

3.3. Peculiarities of the Formation of Graphic and Informational Competence Among Students of Energy Specialties

The modern education system has reached another turning point. Processes of humanization, democratization of society, scientific and technical progress and general computerization require a mandatory renewal of the educational paradigm.

The implementation of modern technology in all spheres of society's life is one of the priority areas of our country's development. Human activity now largely depends on the ability to effectively use modern technology to achieve the necessary goals. As the most important condition that ensures a person's success, demand on the labor market, and a comfortable life, computer literacy and computer education are increasingly being called, and information culture has become an integral part of the personality culture of a modern person [2].

In recent decades, the idea of informatization of the educational process has gained special relevance in Ukraine as an important means of improving the educational system and ensuring the progress of society in general. The emergence of new information technologies associated with the development of computer tools and telecommunications networks made it possible to create a qualitatively new information and educational environment as a basis for the development and improvement of the professional education system.

Modernization of education requires the training of a qualified worker of the appropriate level and profile, competent, responsible, fluent in his profession, capable of effective work in his specialty at the level of world standards, ready for constant professional growth, social and professional mobility [5].

An important place in the formation of a competitive specialist is played by the formation of information competence. In the modern world, information technologies play an important role in both natural and scientific and engineering research [8]. The results of modern studies devoted to the examination of various aspects of the professional-competent orientation of education have been the subject of research in recent decades, but when considering the concept of "information competence" the peculiarities of its content for students of energy majors who belong to the social group of non-programming users of personal computers are not taken into account utters.

A competent model of a specialist is a complex system containing a set of managed interacting elements that reflect the field of activity, applied technologies, professional and psychological characteristics of the subject [6]. The elements of the

model should be formed both on the basis of data obtained as a result of the analysis of industry qualification requirements, and on the results of a survey of experts representing manufacturing enterprises, scientific and design and development organizations.

Today, it is impossible to train qualified specialists in the energy profile without an equipped information and technical base of an educational institution, since the use of computer technologies as a tool can effectively and timely solve many professional tasks [7].

Modern information technologies have taken on a decisive role in the creation of processes of practical professional activity. Numerous computer programs for virtual modeling influence the design processes of the form of energy objects. Modern energy engineers actively use the possibilities of information technologies in the search for new architectural forms and, as a result, new approaches in design and modeling are developed. Designers are armed with new tools related to the new possibilities of 3D modeling in the construction of architectural forms.

For several years, Berdyansk State Pedagogical University has been actively using information and software in the training of energy specialists. The analysis of the use of computer technologies showed positive aspects in the professional training of students of energy specialties. The speed and quality of work and projects has increased with the help of specially developed computer programs used in the educational process. Access to information has become much easier. Without getting up from the computer, the student can find and print any information from the Internet, which also saves time directly for creativity. An important role is played by the compactness of the project placed on electronic media and, as a result, the convenience of moving it and transferring files over the Internet instantly and over any distance, which is very relevant during distance education. Advantages include a wide selection of colors and color relationships, the ability to quickly copy.

The concept of information modeling fundamentally changes the perception of the role of computer technology in architectural design. The computer is not used to prepare a set of electronic drawings and specifications, but to create a single information model of a power plant [1].

In order for students to quickly and effectively master the energy profile of professional information programs, the university has created a system of continuous education in the field of information technologies, which provides multi-level training.

At the initial stage of training of bachelors of this profile, the curriculum includes such disciplines as computer science and information technologies in professional activities.

In our opinion, the study of many sections of the discipline of informatics is not relevant enough. For example, the study of number systems is not important, since they are practically not used in professional activities. Learning programming languages is also an inefficient activity for two reasons: firstly, students have weak mathematical training, and secondly, the discipline is studied for a maximum of two semesters, which is very little for training a qualified programmer.

Informatics training should also be oriented towards the professional activity of the future specialist.

Already at the initial stage of his training, the student must acquire propaedeutic knowledge about the use of informatics methods and tools in professional activities. Such an effect can be achieved only in the conditions of solving tasks with a technical content in the informatics course. The use of such tasks in education will form a positive motivation among students regarding the computer science course. Future specialists of the technical profile should orientate themselves in the subject means of informatics, select them all the necessary solutions to production problems.

The main part of classroom time in the informatics course is occupied by laboratory work, where students acquire practical skills in working with personal computer software and work variably with the material. On the basis of the Berdyansk State Pedagogical University, a special course "Computer Design and Modeling of Technical Objects" was developed and implemented in the learning process, which consists of four parts, including nine modules. The special course accumulates various forms of conducting classes, from consultative conducting of classes by the teacher to independent acquisition of knowledge by students. Each module is an independent content line of the course, and the study sequence can be arbitrary. Tasks included in the special course are inextricably linked with the main educational program of the students, their specialization.

It is interesting that the tasks included in the special course meet not only informational, but also developmental goals, as they involve the establishment of broad connections and generalizations in the studied material, the transfer of acquired knowledge and ways of operating on it to new material. The structure of the textbook is presented in such a way that the theoretical material is interspersed with practical and independent tasks of applying the acquired knowledge in future professional activities.

The manual has a large number of illustrations. At the end of each practical work there are control questions. It should be noted that for a more effective use of the special course, variable methods have been developed that implement the psychological and pedagogical effect of a long-term nature, which are based on the achievements of modern psychological and pedagogical science and the ideas of informatization of education and lead to the intensification of the process of the student's personality development – the basis.

Conducted slices showed an increase in success, tasks were completed accurately and qualitatively, according to a sample or in a creative style, in some cases in a shorter period of time.

The adaptive approach and modularity of the developed special course significantly increased the efficiency of the organization and conduct of laboratory work. As a result, the level of quality of education increased, as well as the meaningfulness of students' knowledge, and the basic skills and abilities became stronger.

When studying the discipline "Information technologies in professional activities", students acquire the first skills with automated design systems AutoCAD, ArchiCAD, MathCAD, 3D-MAX and prepare for the complex application of information technologies in professional activities.

Students learn the use of engineering calculation tools, optimization methods, statistical hypothesis testing; means of visualization of design objects, synthesis of mathematical models and application of other tools necessary for automated design of individual parts, devices and technical systems. At this stage, students realize the importance of the information component of education as a necessary component of engineering and technical training, as well as the active formation of subject-practical and information-theoretical components of competence, motivational orientation and ideas about the connection of information technologies with professional activity.

In the 3rd and 4th courses of the discipline "Technology of simulation of energy objects", students must demonstrate their ability to use modern information technologies, independently use application software packages when performing certain tasks in course and diploma projects.

Information competence of a specialist permeates all types of his professional activity and has a general intellectual character. This is primarily related to the need and willingness to work in a new information environment, the fundamental difference of which from the traditional one is the specificity of its technological subsystem [4].

The presence of information competence is characterized by the opportunity and readiness to realize one's intellectual potential (knowledge, skills, experience) in the field of information technologies and to realize its necessity for successful creative professional activity [3].

While preparing the educational standards of higher professional education, the university definitely focuses on the requirements of employers - project organizations where students undergo internships. The experience of training construction profile students and positive feedback from employers confirm the need to use the latest computer technologies in the modern educational space in combination with traditional academic methods of drawing and painting. This allows to harmoniously form the qualities necessary for the future engineer-pedagogue, which are presented to the level of training at the stage of educational development.

Thus, it can be concluded that currently it is not enough to simply teach students of the energy profile how to work with a computer and various applied software products. It is also necessary to form information competence in them, which contributes to the formation of the need to apply the acquired knowledge in their practical activities.

Reference

1. Авдєєнко А. П., Дементій Л. В. Організація самостійної роботи студентів. *Проблеми освіти.* Випуск 33, 2003. С. 246–250.

2. Агаджанова Р. Адаптивне управління самостійною роботою студентів. *Новий колегіум : науковий інформаційний журнал.* Харків, 2010. №6. С. 30–34.

3. Буряк В. Самостійна робота як системоутворюючий елемент навчальної діяльності студентів. *Вища школа : науково-практичне видання.* Київ, 2008. №5. С. 10–24.

4. Жалдак М. І., Хомік О. А. Формування інформаційної культури вчителя. *International Charity Foundation for History and Development of Computer Science and*

Technique ICFCST : веб-сайт. URL: http://www.icfcst.kiev.ua/ (дата звернення: 13.02.2024).

5. Концепція інформатизації. *Рідна школа*. 2014. №10. С. 26–29.

6. Куракін Д. В. Інформатизація освіти : підсумки та перспективи розвитку. *Проблеми інформатизації вищої школи*. 2015. №1. С. 27–33.

7. Мараховський Л. Ф. Проблеми методичного забезпечення з дисципліни «Інформатика та комп'ютерна техніка». *Збірник «Запровадження сучасних технологій навчання в КНЕУ*. Київ : КНЕУ, 1999.

8. Матвієнко О. В. «Електронний підручник» у системі дидактичного забезпечення комп'ютерних технологій навчання. *Нові технології навчання.* 2014. Вип. 29. С. 132–135.

9. Нагаєв В. М. Методика викладання в вищій школі : навч. посіб. Київ : Центр навчальної літератури, 2007. 232 с.

10. Онищенко С. В. Використання ІКТ в педагогічній діяльності вчителя-предметника. *Неперервна освіта нового сторіччя : досягнення та перспективи : збірник наукових праць ЗОІППО за матеріалами ІІ Міжнародної науково-практичної конференції (18-25 квітня 2016 р.)*. 2016. № 2 (24). С. 74–78.

11. Онищенко С. В. До проблеми викладання технічних дисциплін при підготовці спеціалістів за напрямом «Професійна освіта. Енергетика». *Наукові записки Бердянського державного педагогічного університету. Серія: Педагогічні науки : зб. наук. пр.* Випуск 2. Бердянськ : БДПУ, 2022. С. 304–310.

12. Онищенко С. В. Застосування ІКТ в викладанні дисциплін циклу машинознавства під час підготовки майбутніх учителів технології. *Збірник наукових праць Уманського державного педагогічного університету імені Павла Тичини* [гол. ред.: М. Т. Мартинюк]. В 1. Умань : ФОП Жовтий О. О., 2015. С. 252–257.

13. Онищенко С. В. Місце дисциплін енергетичного циклу у формуванні професійної компетентності студентів енергетичних спеціальностей. *Development strategiest for modern education and science : Materials of the III International research and practical internet conference (February, 28, 2022) : collection of abstracts*. Zdar nad Sazavou : «DEL a.s.», 2022. P. 27–30.

14. Онищенко С. В. Технологія формування професійної компетентності майбутніх учителів технології. *Науково-дослідні публікації. Серія «Інформатика і техніка»*. 2014. № 7 (11). С. 44–52.

15. Онищенко С. В. Формування професійної компетентності майбутнього вчителя технології засобами інформаційно-комунікативних технологій. *Науковий часопис Національного педагогічного університету імені М. П. Драгоманова. Серія №5. Педагогічні науки: реалії та перспективи*. Випуск 31. Київ : Вид-во НПУ імені М. П. Драгоманова, 2012. С. 154–159.

16. Основи нових інформаційних технологій навчання : Посібник для вчителів. Авт. кол. за ред. Ю. І. Костюка АПН України. Київ : ІЗМН, 1997. 264 с.

17. Рябченко В. А. Деякі концептуальні проблеми освіти і виховання студентів в сучасних вищих навчальних закладах України. *Вища освіта України*. 2005. № 3. С. 40–45.

18. Onyshchenko S. Formation of ICT-Competence of the Future Specialist in the Energy Industry in the Conditions of Informatization of Education (Distance

Education). *The latest foundations for the development of production, science and education – 2023 : collective monograph.* Nová Dubnica : NES Nová Dubnica s.r.o., 2023. P. 37–55.

19. Onyshchenko S. New Information Technologies in the Conditions of Distance Education. *Наукові записки Бердянського державного педагогічного університету. Серія: Педагогічні науки : зб. наук. пр.* Випуск 3. Бердянськ : БДПУ, 2022. С. 172–178.

20. Onyshchenko S. Psychological and Pedagogical Foundations of the Application of Modern Information Technologies in the Educational Process of Future Specialists in the Energy Industry. *European vector of modern education, science and production – 2023 : collective monograph.* Nová Dubnica : NES Nová Dubnica s.r.o., 2023. P. 57–73.

21. Onyshchenko S. Visual Means in the Educational Activity of Professional Teachers of the Professional Education System. *Scientific and research work in the system of teacher training in natural, technological and computer spheres : materials of VIII international scientific conference (with the international participation), Berdyansk, September 16-17, 2021.* Berdyansk : BSPU, 2021. P. 213–215.

Keywords: creativity, creative abilities future teachers of technology, educational process, higher education institution.

CHAPTER 3. Serhii Onyshchenko THEORETICAL FOUNDATIONS OF THE FORMATION OF GRAPHIC AND GRAPHIC AND INFORMATIONAL COMPETENCES OF STUDENTS OF ENERGY SPECIALTIES ON THE BASIS OF TRAINING AT A PEDAGOGICAL UNIVERSITY

An important place in the training of a competitive specialist in the energy profile is played by the formation of informational competence. The section examines the peculiarities of the formation of graphic and informational competence of energy major students with the aim of forming a competitive specialist. The reasons for the low level of formation of graphic competence among first-year students are considered. A description of the use of information technologies and professional information programs in the training of engineer-pedagogues is given. The main stages of the formation of graphic and informational competence of students of the energy profile on the basis of training at a pedagogical university are given. The methodical features of the special course developed for students of the energy training profile are considered. The stages of students' independent work are identified and systematized.

Keywords: information technologies, software, information educational environment, graphic competence, information competence, teaching methods.

ABOUT THE AUTHORS

CHAPTER 1. MODERN BASICS OF ECONOMICS, MANAGEMENT AND TOURISM

1.1. Lesya Donchak – PhD, Associate Professor, Vinnytsia Educational and Scientific Institute of Economics Western Ukrainian National University, Ukraine

Iryna Martusenko – PhD, Associate Professor, Vinnytsia Educational and Scientific Institute of Economics Western Ukrainian National University, Ukraine

Halyna Boikivska – PhD, Associate Professor, Lviv Polytechnic National University, Ukraine

1.2. Mykola Odrekhivskyi – Doctor of Sciences (Economic), Professor, National University "Lviv Polytechnic", Ukraine

Orusia Phsyk-Kovalska – PhD (Economics), Associate Professor, National University "Lviv Polytechnic", Ukraine

1.3. Zoriana Koval – Candidate of Economic Sciences, Associate Professor, Associate Professor of the Department of Accounting and Analysis, Lviv Polytechnic National University, Ukraine

1.4. Natalia Kara – PhD in Economics, Associate Professor, Lviv Polytechnic National University, Ukraine

Sviatoslav Penhryn – Postgraduate Student, Lviv Polytechnic National University, Ukraine

1.5. Nataliya Hryniv – Ph.D., Assoc.Prof., Lviv Polytechnic National University, Ukraine

Taras Danylovych – Ph.D., Assoc.Prof., Lviv Polytechnic National University, Ukraine

CHAPTER 2. INNOVATIVE AND MODERN FOUNDATIONS OF PEDAGOGY AND PSYCHOLOGY

2.1. Nadiia Borysenko – Candidate of Pedagogical Sciences (PhD), Senior Lecturer of the Technological and Professional Education Chair, Oleksandr Dovzhenko Hlukhiv National Pedagogical University, Ukraine

2.2. Alina Dmytrenko – Doctor of Philosophy, Senior Lecturer of Theory and Methodics of Preschool Education Chair, Oleksandr Dovzhenko Hlukhiv National Pedagogical University, Ukraine

2.3. Olena Nikitina – Candidate of Pedagogical Sciences, Associate Professor, Associate Professor of the Department of Preschool and Primary Education, Central Ukrainian State University named after Volodymyr Vinnichenko, Ukraine

2.4. Liudmyla Lukaniova – Senior Lecturer of the Department of Special and Inclusive Education, Lesya Ukrainka Volyn National University, Ukraine

2.5. Dmytro Tsys – Candidat of Pedagogical Sciences, Associate Professor, Oleksandr Dovzhenko Hlukhiv National Pedagogical University, Ukraine

2.6. Tetiana Khoruzhenko – Pedagogical Sciences Candidate (PhD), Assistant Professor, Assistant Professor of Technological and Professional Education Chair, Oleksandr Dovzhenko Hlukhiv National Pedagogical University, Ukraine

CHAPTER 3. THEORETICAL FOUNDATIONS OF THE FORMATION OF GRAPHIC AND GRAPHIC AND INFORMATIONAL COMPETENCES OF STUDENTS OF ENERGY SPECIALTIES ON THE BASIS OF TRAINING AT A PEDAGOGICAL UNIVERSITY

3.1., 3.2., 3.3. Serhii Onyshchenko – PhD, Associate Professor, Associate Professor of the Department of Professional Education, Labor Training and Technologies, Berdyansk State Pedagogical University, Ukraine