PECULIARITIES OF THE ORGANIZATION OF EDUCATIONAL ACTIVITIES OF STUDENTS OF THE AGRICULTURAL HIGHER EDUCATION INSTITUTIONS IN THE CRISIS CONDITIONS

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The scientific monograph presents theoretical-methodical and practical aspects of organizing the process of student education in crisis conditions. Using the example of the educational process in agricultural universities, ways to improve independent graphic training are considered, a mathematical model for designing educational resources is proposed, the problems of teaching physics and the methodological foundations of online education in crisis conditions are highlighted.

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CHAPTER 1 "ORGANIZATION OF INDEPENDENT GRAPHIC TRAINING OF STUDENTS IN CRISIS CONDITIONS"

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Abstract. Higher education of Ukraine as a system is in a state of constant development and transformation. The directions of its strategic development are focused on joining the European Education Area, modern information technologies and priorities of human needs in modern society. However, since 2022, Ukrainian higher education has faced significant challenges. The pandemic and Russian aggression created special difficulties in the formation of modern higher education in our country. During Covid, the main problem of studying at universities was related to ensuring quality distance learning and controlling learning. The war with russia has caused even greater destruction of the professional training system. It has led to the suspension of universities in the temporarily occupied regions of our country and the forced relocation of students and teachers. Air alarms cause disorganization of the educational process. According to experts' estimates, the amount of damage to the Ukrainian educational infrastructure as of the beginning of 2023 is almost 8.2 billion US dollars.

In crisis conditions, it is important to ensure quality training of engineers for our country. Graphic training plays an important role in the professional activity of an engineer. Graphic activity has certain features that are related to the complexity of operating spatial images. Forced distance learning changes the types of communication between the teacher and the student. Taking into account the state of training of specialists in the crisis conditions in which the higher education of Ukraine found itself, the use of the potential of self-education activities during the graphic training of students is gaining relevance. Self-education has always been considered one of the most important components of the formation of a future specialist, which has deep roots and a historical path of development. However, modern technologies substantially change instruments and strategies of her use in

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educational activity of students. Internet networks, social communities, and university educational environments provide free access to endless amounts of information. The controlled from distance studies, at certain terms, create possibilities to the receipt of the quality, logically organized system of knowledge, that gives an opportunity to support contacts between students, take part in general projects, to carry out researches.

The purpose of the research is the theoretical and practical principles of substantiation and introduction into the educational process of the model of self-educational graphic activity of students in crisis conditions and pedagogical conditions of its implementation.

The research methodology is based on basic research in the philosophy, pedagogy and psychology of professional education. Theoretical methods: analysis, synthesis, comparison, generalization of scientific research information to clarify the nature and role of students' self-education in the crisis, the degree of development of the problem; empirical methods: conversation, interviews, questionnaires, surveys to find out the peculiarities of students' independent work, testing to check the effectiveness of the proposed methodology.

Conclusions. Graphic training is an important component of the professional training of future engineers, which has a special specificity (high level of abstraction of graphic information, the need to perform mental spatial operations of graphic information). To ensure the effective organization of independent graphic training, we distinguish three pedagogical conditions: the creation of an integrated information learning environment with systematic updating of educational content; the introduction of methods for forming students' readiness for self-educational graphic activities; systematic involvement of students in scientific activities. Practical implications. The introduction of pedagogical ones ensures effective organization of independent training of students and contributes to the formation of professional competence of the future engineer. The value/ originality of the research lies in the use of a complex approach to solving the problem of independent graphic activity of students in crisis conditions.

Introduction

The relevance of the study is due to the contradictions between the challenges faced by Ukraine as a result of the pandemic and russian aggression and our country's need for specialists capable of overcoming

the consequences of the crisis; the constant development of innovative technologies and traditional teaching methodologies in higher education; the need for effective self-education of students and the weak focus of universities on this type of educational activity.

The graphic training of future engineers is the basis for studying professional disciplines and one of the main means of the engineer's professional activity.

The high level of abstraction of graphic information, which requires developed spatial thinking when operating it, prompts the search for effective organization of students' independent activities.

The object of the research is professional training of students in crisis conditions.

The subject of the research is the self-educational graphic activity of students in times of crisis.

According to the purpose, object and subject the following tasks are allocated:

1. To define the role and essence of the student's self-educational graphic activity in crisis conditions.

2. To analyze the current state of students' self-education in the context of the crisis, to clarify the concept of "students' graphic self-education" and to define its structure.

3. Creation of an integrated informational educational environment with systematic updating of educational content for graphic training of students.

4. To analyze the conditions for the introduction of methods of forming students' readiness for self-educational graphic activity.

5. To reveal the potential of systematic involvement of students in scientific activity as a condition for the formation of motivation for independent graphic activity.

The problem of self-education has been studied by Ukrainian and foreign scholars and practitioners: Bodrova I. [1], Boychuk V. [2], Borysenko N. [3], Bronnikova L. [4], Gorban Y. [6], Gluzman O. [7], Kovalenko S. [10], Smahulova N. [12], Chamorro-Premuzic T. [25], Karen K. Garza [26] and other. However, having regard to crisis situations that arose up in Ukraine and exceptional role of self-education activity for a student in the complicated situations of receipt of higher education, it is necessary to mark expediency of realization of research of this problem.

Students' independent work has enormous didactic potential, as it not only helps them to learn the material, but also to expand it, develop the ability to work with different types of information, and develop analytical skills, control and planning skills.

The analysis of the state of educational activities of future engineers, which we conducted during 2020–2023, allows us to state the insufficient level of organization of independent graphic training of students. In particular, as shown by the control sections and the results of examination sessions, compared to the 2019–2020 academic year, over the past two years of our observations, there has been a steady downward trend in academic performance in graphic disciplines. Attention should be focused on the deterioration in the quality of drawings, the inability to find errors on their own, and the inability to apply graphic techniques to other types of learning activities. The reasons for this situation are revealed. During distance learning, communication with the teacher is limited. When checking individual graphic assignments, the teacher has two options: to receive the graphic work by e-mail or viber and send comments on the quality of its implementation or to comment on the mistakes made during the class in ZOOM on the screen. Both options have their drawbacks, primarily because students send photos or screenshots of their work, which are not always of high quality, and students do not always insist on explaining mistakes. In addition, it is clear that the teacher does not have the opportunity to give a detailed comment. In face-to-face communication, the teacher controls the process of correcting mistakes; in distance learning, the situation is different. If the student understands the explanation, the error will be corrected. If the student did not understand the explanation and did not show persistence, the process of completing individual graphic tasks becomes time-consuming, the work accumulates, and this leads to a negative result.

1.1. Social Prerequisites for the Development of Independent Graphic Training of Students in Crisis Conditions

The modern system of higher education aims to provide fundamental scientific, professional and practical training for future specialists, which is determined by social, economic and technological changes in society. However, the full-scale war in Ukraine has completely changed the conditions for achieving this goal. On February 24, 2022, the Ministry of

Education and Science of Ukraine recommended suspending the educational process and sending students on a two-week vacation. Over time, the higher education system has adapted to functioning in a war. Universities began to actively introduce distance and blended learning, and students were allowed to have individual schedules, academic leaves, etc. In this context, students' independent work is becoming a leading type of educational activity.

Education is interpreted as "a social process of development and self-development of a personality associated with the acquisition of socially significant experience embodied in knowledge, skills, creative activity, sensory and value forms of spiritual and practical development of the world" [4; 8]. Among the modern conceptual approaches to the organization of educational activities are systemic, personal, communicative, humanistic, activity and competence approaches aimed at the effective implementation of modern social needs by pedagogical means and achieving compliance with the main highways of human development in the general historical aspect. As Fedoruk P. rightly notes, it is society that determines the essence and direction, priorities and values, purpose and method of organizing the educational process [20].

Innovative processes are especially relevant for engineering education, as it is in the field of engineering and technology that information and knowledge are rapidly updated, and the responsibility of a specialist for the results of his or her work is growing, which requires a high level of value and semantic readiness for professional activity. Increasing requirements for engineering education, expanding its role and potential in society and the market require the generation of synergistic, holistic and high-quality strategies for its development. Compared to the previous stages, these strategies are aimed at revising the entire higher education system, improving the quality of education, stimulating research activities, and combining technical and non-technical aspects of students' professional development. According to Zou Chengzhan and others, modern engineering is a cultural human activity that involves the interaction between theory, experimentation, and imagination, in which humans shape and transform nature for practical purposes and tasks using tools and processes [21; 24]. It should be emphasized that these "practical goals and objectives" include human society in all its complexity. Applied sciences and technologists need to find solutions to various scientific problems that will work in real conditions and must be holistic, which means

they must be developed on the basis of an integrated approach. The challenge is for engineers to be not only technocrats, but also intellectuals who are the creators of the technical culture of society.

Synthesis of knowledge, mutual enrichment of sciences both within individual fields and externally with related humanities, fundamental, natural and technical sciences are becoming the defining trends of change in the modern education system [1; 7]. There is a constant debate about the effective formation of curricula for higher technical education, the use of effective pedagogical methods, the creation of opportunities for research, and the enhancement of the student's personal status.

According to J. Williams, Dean of the Massachusetts Institute of Technology, engineering has become an open "profession of everything" in a world where technology affects society, art, and government. All the forces that pull the engineering industry in different directions – towards science, towards the market, towards socialization – add to the obstacles in creating effective curricula" [28]. According to J. Williams, curricula should be aimed at combining technological and humanitarian sciences and preparing students for real life.

The Accreditation Board for Engineering and Technology (ABET) requires that engineering education programs promote an understanding of professional and ethical responsibility, as well as the "broad education" necessary to understand the impact of engineering decisions in global economic, environmental, and social contexts. Students studying engineering structures and technological processes are expected to be involved in solving social, economic, and cultural problems in the design process [28]. In addition, this holistic approach takes into account much more than just a narrow, "technical" vision of the problem, and most scientists agree that the humanities and social sciences play an essential role in the professional training of modern process engineers. Among the criteria for the quality of engineering education, AVET has identified six components that are not usually considered as the goals of engineering disciplines: the ability to work in interdisciplinary projects; exercise of professional and ethical responsibility; ability to communicate effectively; group work skills; a conscious approach to solving engineering problems that affect economic, social and environmental well-being; and the ability to learn throughout life [29].

We are convinced that reforming the modern paradigm of engineering education is impossible without due attention to the study of humanities, which, in turn, should correspond to the multifaceted concept of modern educational approaches and be part of a synergistic system for training a competent modern specialist. The main task of the new education paradigm should be to use a modern methodology based on the principle of pluralism of scientific approaches and methods. The discussion method of finding out the truth, dialogic forms of education. Humanitarian training can become the core foundation of personality formation, an integral component in the creation of socially significant personality parameters, and at the same time positively correlate with other components of the overall context of professional training.

Reforming education to achieve a new level of quality based on a competency-based approach, we cannot do without a whole range of linguistic, humanitarian and cultural disciplines, as we cannot exclude psychological, cultural and other patterns of personal development in the learning process, which requires the humanization of the entire educational process and due attention to the humanitarian component of curricula and programs.

When reforming education to achieve a new level of quality based on a competency-based approach, we cannot do without a whole complex of linguistic, humanistic, and cultural disciplines, since we cannot exclude psychological, cultural, and other laws of personality development in the education process, which requires the humanization of the entire educational process and proper attention to the humanitarian component of educational programs. At the same time, an important guarantee of increasing the effectiveness of the role of humanitarian disciplines is the complex didactic purpose of their content, which is based on general requirements for the education of a specialist, structuring the content in accordance with the goals of professional training, a differentiated approach to structuring the content of educational material, its actualization and updating [3].

Other ways to reorganize the content of education, typical of modern educational reforms, may be intensive approaches to the study of humanities, which involve structural restructuring of course programs to include new scientific achievements, providing programs with the qualities of flexibility, openness, and variability. This will allow for the optimal selection of the

array of basic educational information and teaching approaches, and the implementation of the content of educational material "at different levels of problematic" [3, p. 35].

At the present stage, the need to prepare students to navigate the spectrum of topical issues of our time is becoming a priority. In the didactic model of structuring the content of humanities disciplines, Smahulova N. draws attention to the need to create such learning situations in the process of their study that would develop students' organizational, intellectual, reflective and communicative skills as a basis for the formation of relevant professional qualities, abilities, skills, competencies [12]. The content of humanities disciplines should be focused on the formation of a humanistic picture of the world and a system of professional and pedagogical skills, and the presentation of the material should be based on the laws of students' educational and cognitive activity. Humanitarian disciplines are key to the implementation of such aspects as: the historical aspect – the history of development, problems and ideas in national and world traditions; the social aspect, theoretical and value aspects that form goal setting and worldview orientation; problem-practical and communicative aspects that can broaden students' horizons and opportunities. Special attention should be paid to learning a foreign language, which is seen as one of the main means of increasing the competitiveness of individuals in the labor market and intensifying intercultural communication and cooperation. The expansion of international dialogue, which promotes the global exchange of knowledge, practices and best practices, is transformed into real results. At the same time, learning a foreign language positively correlates with success in other areas of the context, can serve as an effective tool in the system of scientific knowledge, and contributes to the formation of an interdisciplinary view of the curriculum.

Training should be aimed at facilitating the process of mastering a certain type of activity in a single concept of mastering the worldview and interpretation of reality, the main goal of which will be the formation of a competent specialist in all aspects. This can be facilitated by the method of interdisciplinarity and contextualization of learning, which is a theoretical generalization of the practical experience of "active learning", the use of project technologies that implement the principle of partnership and cooperation and can encourage students to be active and learn independently. These methods and technologies

can become the main meaning-forming categories that reflect the influence of the subject and social contexts of the student's future professional activity on the process and results of his learning activities and at the same time are an application of the teacher's pedagogical skills.

Thus, engineering education requires a comprehensive and holistic approach to training future engineers and is aimed at forming a competent, highly educated personality. This requires the integration of technical knowledge and experience, socio-cultural analysis, development of innovative thinking, decision-making, professional ethics, and social responsibility. The humanitarian component of the curriculum should contribute to the formation of a professional, intellectual, creative personality with a cognitive mentality determined by cultural values; orientation in the socio-cultural environment, and, ultimately, the formation of an image of a full-fledged participant in all educational, professional and social processes. The revision of curricula and their adaptation to modern requirements, the need for effective integration of humanities and social sciences are key issues in engineering education that require further consideration.

The change in the educational paradigm, the crisis situation in Ukraine and its desire to join the European educational space increase the importance of self-education in higher education. The main idea of self-education is the need for continuous development of a person as a professional and social subject. In the information society, specialists are needed who are able not only to accumulate but also to produce knowledge of science, practice and culture, and to have creative thinking. Therefore, L. Korostil proposes to consider self-education as an activity of accumulating, organizing and systematizing knowledge, primarily for the formation of professional competence, taking into account the satisfaction of human cognitive needs and for various activities that provide access to information and its operation [11].

The motives for self-education can be divided into three groups.

The first group of motives:

– associated with the need to constantly work with information resources. Such work (usually of a professional nature) involves searching for, analyzing, and processing information;

– high-quality professional activity requires continuous improvement, including the ability to participate remotely in master classes, conferences, webinars, etc;

– modern professional activity and the process of achieving success are creative in nature, involving the adoption of non-standard solutions and innovations.

The second group of motives is related to the transformation of society as a whole:

– the transformation of a person's worldview in line with dynamic changes in society requires the search for relevant information;

– the high level of competition in the labor market creates a need for mastering new information technologies, knowledge and skills in the latest types of activities.

The third group of motives reflects the material aspirations of a person in society:

– material motives are considered to be among the most important. Financial incentives received by a specialist from an employer are an important incentive to improve their skills, change their type of activity or move to another position.

Today's complex conditions of social life change the worldview and philosophy of human thinking, require an independent search for new knowledge, the choice of new behavioral strategies, value orientations, and the rational organization of professional and personal life. Self-education is not only a process of gaining social experience, but also contributes to the improvement of a person as a person and his or her continuous intellectual growth.

The development of self-education should be viewed not only in the social context, but also more broadly in the historical, political, economic, national, ethnic, and geopolitical contexts. Thus, scholars view self-education as a complex socio-cultural phenomenon. This phenomenon is correlated with a specific era and historical experience.

It can be assumed that self-education can serve as a basis for creating an image of the future socio-cultural reality and shaping the future generation.

The historical roots of self-education are extremely deep. Philosophers of ancient Greece associated the concept of self-education with the process of self-knowledge and self-improvement. The development of book printing in the Middle Ages contributed to the expansion of access to information. This can be considered a certain stage in the development of self-education. The era of capitalism is the next stage in the development of this phenomenon.

The emergence of new machines and mechanisms, the transition from manual labor to mechanized production in almost all sectors of the economy required workers with a certain level of training and the ability to master new technologies of the time. The improvement of human life in this era is directly related to the level of education. It is no coincidence that during this period many inventions were made by people who acquired knowledge on their own. It was at this time that self-education, the ability and desire to learn became valuable and important characteristics of a person as a generator of new ideas that ensure the dynamic development of society.

Today, self-education is considered to be the engine of spiritual growth, individual development, and the acquisition of a wide range of knowledge and skills necessary for work and life.

In the era of digital culture, self-educational activity acquires an important importance in the context of information development. New information technologies, such as educational platforms, blogs, electronic libraries and virtual universities, create ample opportunities for self-development and self-improvement. The functions of self-education in the context of information technology training are as follows:

– providing a variety of effective learning tools and methods; creating individual learning paths;

– availability of various forms of self-education (online courses, virtual university, webinars, etc.);

– providing modern and updated educational content;

– dynamism in the development of information technology skills at each stage of learning;

– mastering various types of student learning activities based on information technology;

– providing advanced and developmental learning;

– tracking the dynamics of the development of information educational technologies in the educational process.

The information society allows us to move to a qualitatively new level of educational process and self-education.

Among the characteristic features of modern educational activities in the context of information technology, I would like to note the following:

– increasing the importance of self-education for a specialist. The need for continuous improvement of knowledge and skills in the information

sphere, the presence of "computer culture" as a new form of professional activity and communication between people;

– changes in the organization of self-education activities, principles of planning and achieving results with the help of information technologies;

– access to the means of accumulation and processing of mass information (mathematical, statistical calculations, etc.), which expands the conditions for creativity and integration of all types of self-education;

– formation of a new type of social relations, the possibility of remote work, including abroad.

In the context of market relations, self-education is becoming increasingly important as a tool for social mobility that ensures social mobility and, at the same time, opposes the conservatism of traditional education. The phenomenon of self-education can be seen as a response to the education crisis that has become a global problem. Contemporary criticism of higher education shows a discrepancy between the real state of learning activities and the potential of self-education.

Another important aspect of self-education is its impact on the psychology of the future specialist's behavior. For example, Karen Garza, associate professor at the University of Thessaly (Greece), considers self-education activities in student life to be an indicator of mental well-being [26]. This study is undoubtedly important, because the vast majority of research on self-education is related to finding ways to ensure that students meet the requirements of the professional activity for which they are preparing. The author believes that knowing ways to improve students' mental health and implementing them will help prevent many negative phenomena (reduced motivation to learn, emotional burnout, anxiety, depression, apathy, etc.), and can also have a positive impact on youth employment, the replacement of competent jobs, and the development of society as a whole [29].

Modern higher education is focused on an individual approach to learning, creating individual learning and development trajectories for each student.

Today, critics of higher education argue that spontaneous self-education can significantly change the role of universities in training specialists. Information technology provides access to the libraries of leading universities, the opportunity to listen to lectures by the world's leading scientists, and to communicate in social groups of interest.

As Zou Chengzhang points out, in today's technological world of information, educational services and academic systems are also in the process of adapting information technology solutions. Information systems differ for different programs, and in the academic field in particular, there are a number of information systems available in different institutions around the world. E-learning integration can optimize the implementation of computerized and automated educational processes at all levels. Zou Chengzhang emphasizes that educational institutions are also in the process of adapting information systems to the needs of learning [21].

Every branch of education uses information systems in one way or another. Traditional audience can now be replaced by virtual classrooms that provide instructor-less learning. A student living in Asia can now study courses taught in America. Traditional blackboards have been replaced by digital interactive whiteboards, and the physical library has become an online library. Access to information has become universal [23].

In certain questions, it is possible to argue with radical criticisms of higher education. It is however difficult not to agree, that information technologies open new possibilities for self-training and self-development of future specialist.

In our opinion, it is important to consider self-education as a holistic and orderly system with clearly defined characteristics and tasks:

– everyday self-educational activity: the goal is the assimilation of social experience;

– cognitive self-educational activity: the goal is to learn about the surrounding world;

– professional self-education activity: the goal is to achieve the desired level of professional competence and social significance.

The functions of self-educational activities are common to all types of educational activities. Among them, we distinguish: extensive, indicative, compensatory, self-development, methodical, communicative, co-creative, psychological [2; 5; 8; 17; 20].

In the process of self-educational activity, a student passes the certain stages from more subzero to higher that can be distinguished like to the processes of cognition. The trajectory of self-educational activity is directed from adaptation to reproductive activity and, further, to a high degree of

efficiency, awareness and use of the norms of the scientific style of thinking. Based on the analysis of self-education, we identify three main levels.

– Motivational level: analysis of stimulating factors for self-education, initial state of readiness for self-education, but unsystematic organization of independent activity, spontaneous attempts to satisfy cognitive needs, lack of a clear goal and plan for self-education.

– Cognitive level: the process of self-education is systematic and purposeful, with clearly defined goals and objectives, but discrete in nature.

– Creative and reflective level: there is a full motivation for self-education, self-education is carried out as a systematic, continuous, motivating, conscious process.

Personal motivation is a key factor that determines students' self-education activities, as it reflects personal orientations and aspirations to achieve success. The self-educational activity of a student as a future specialist is to master the knowledge, methods, technologies and culture of professional activity, as well as to develop problem-solving skills and work independently on their personal and professional development.

First of all self-education should be viewed as a systematic, purposeful process based on a clear organization of independent cognition and the formation of the necessary skills. Any activity requires knowledge of the methods of performing this activity. Therefore, an important condition for self-education is knowledge of self-education techniques. Personal motivation is the main factor in a student's self-education, which consists in mastering the knowledge, techniques, technologies and culture of professional activity. For successful self-education, it is necessary to master self-education techniques, such as the alternation technique and the Leitner method. The interleaving technique involves the simultaneous study of several subject areas for the comprehensive assimilation of information. Leitner's method, which uses flash cards to memorize material, is based on interval repetition (i.e., in a certain content after a certain time). An important condition for self-education is the organization of independent knowledge acquisition. The special value of self-education lies in the ability to independently find and study the chosen field of knowledge. This is one of the motivational foundations of self-education [18].

Based on the results of the SWOT analysis and student survey, we identified the opportunities that self-education offers to future professionals:

– opportunities self-education for future specialists;

– independence ensures research work on the problem;

– targeted study of scientific and professionally oriented literature;

– promotes participation in collective and group forms of various types of work;

– povides theoretical work and practical testing of personal materials;

– promotes active formation of personal experience.

It should be noted that independent work requires a certain level of student readiness, in particular, a formed psychological readiness. This applies not only to a sufficient level of motivation, but also to the ability to self-organize, the presence of will, a certain level of intellectual development, etc. Another important point is the lack of control over the quality of the knowledge gained. In particular, the following questions remain open: does the student correctly understand the information to be learned? Does the student correctly establish the hierarchical subordination of concepts, etc.? Today, self-education is considered a conceptual area of pedagogical science, since it is the awareness of the need for certain information and the efforts to obtain it that contribute to the student's readiness for creativity and innovation.

Finding ways to improve independent graphic preparation requires a precise definition of this concept and clarification of its structure. The concept of "independent study" has various interpretations. Summarizing the definitions of this concept in modern scientific research, we can assume that a specific feature of independent study is the mandatory activity of analytical and research activities of the student. We would also like to emphasize that the implementation of independent work requires strong-willedness. Taking into account the above considerations and the specifics of graphic activity, we believe that independent graphic training of students in crisis conditions is a leading systemic form of graphic education that has a specific structure and purpose. The main goal and organization of independent graphic training should be consistent with the overall goal of training an engineer at the university, the student's own needs and the potential of the educational environment. Among the generalized goals of independent graphic training are the following: systematization and consolidation of the acquired graphic theoretical knowledge and practical skills of students; deepening and expanding skills in computer graphic programs; formation of skills to work

with reference technical documentation, the Unified System of Design Documentation and special literature; development of cognitive abilities and activity of students: creative initiative, independence, responsibility and organization; formation of self In the structure of independent graphic training of students, the following typical elements can be distinguished: the formation of goals and motives, operations and actions, control, reflection on activities and correction.

The analysis of the problem of independent graphic training of students in crisis conditions gives grounds to distinguish three pedagogical conditions that ensure its effectiveness.

Let us consider the theoretical foundations of the formation of students' self-educational activity in the conditions of crisis.

1.2. Theoretical Principles of the Formation of the Student's Self-education Activity in Crisis Conditions

The analysis of theoretical approaches to personal self-education includes the study of its various aspects, ranging from socio-cultural and psychological to economic, which allows us to scientifically substantiate self-education as a socio-cultural phenomenon. Although the study of this issue is ongoing, there is currently no single approach to defining the essence of the term "self-education" and, in light of the events of recent years, the concept of "self-education in times of crisis". Therefore, new scientific research is needed on the organization of students' independent learning activities, and, in particular, with an emphasis on information technologies that can overcome a number of problems related to self-education (as discussed in chapter 1.1).

Referring to official documents, in particular the Law of Ukraine "On Education", it should be noted that the state pays attention to various types of self-education activities. Thus, non-formal education, which can be obtained in the course of daily activities, related to professional, social or other activities, family or leisure is considered as self-organized acquisition of competencies. Continuing professional development is defined as the process of continuous learning and acquisition of a wide range of professional competencies of specialists both after higher and postgraduate education. This allows professionals to meet dynamic standards of professional activity throughout their careers [15].

The modern concept of independent work is inextricably linked to the integration of information technology, which defines the essence of modern educational systems, as it acts as an effective tool for improving the education of future professionals. Education and research in education are complemented by technology, which, in turn, provides innovations in teaching methods. Thus, this impact is interconnected. Information technology accelerates educational processes; expands the scope of the learning process and provides convenient access to education. The use of information technologies (IT), educational platforms and various applications has been characterized by a significant spread in the last decade [4].

The importance of information technologies requires in-depth research to analyze the possibilities of integrating information technologies into educational systems, including for the purpose of providing self-education. Assessment of information technology integration is a complex task because of its complex nature, as it involves assessing direct and indirect changes that occur under the influence of information technology.

An important way to evaluate such integration is through expert evaluation based on user feedback, followed by analysis to determine the impact of these technologies on the level of independent activity. We consider this method of evaluation to be the most generalized and therefore applicable to a variety of information from technological systems. As the analysis of pedagogical studies of information technologies in education shows, these trends are the basis for various studies of information technologies and their impact on e-learning systems in particular [10; 12; 16]. Most of these studies focus on methods to characterize the key factors that influence e-learning strategies to create an effective online learning environment [12]. Evaluation of information technology tools used in these educational processes is rarely carried out, so their full potential is often not used in practice.

Today, research on the evaluation of information technology systems for independent work in the graphic training of future specialists has intensified [4; 8; 11; 14]. Although these studies do not yet fully solve the problem of independent work, since information systems provide numerous advantages that prevent the use of their optimal capabilities, they can be considered insignificant for users. It is relevant to note here that such minor features can improve the process of student learning and the organization of independent work.

We view the integration of educational technologies as a process that includes a system of tools and their corresponding functions. These tools and functions can be used by both students and teachers, who are the main clients of the system. Today, a variety of questionnaires are offered to collect statistical data on the use of IT tools and the frequency of use, which affects the organization of students' independent work. The topology of tools and functions helps to develop a general classification of any phenomena or objects.

The integration of information technology into any educational system is associated with careful planning of the strategy and its implementation. This suggests that only a well-designed integration of information technology in order to organize independent activities allows you to take advantage of the potential benefits of information technology systems. To assess the degree and quality of integration, one should look for methods and techniques that take into account system feedback from the main stakeholders using this integrated system, the main components of which remain the student and teacher.

Questionnaire-based surveys to analyze responses provide an opportunity to significantly test and improve the effective integration of IT with education systems. In addition, note that the validity in a research study concerns what should measure this tool.

One of the models that uses survey, interview and observation tools to assess IT is the IS Impact model [8]. This model is considered to be the most effective for evaluating the integration of information systems of the educational process in the context of organizing self-education activities, as it contains a significant number of questions covering six diverse dimensions: information quality, accessibility of use, user satisfaction, individual impact, system quality, and organizational impact [8; 11; 17].

The questionnaire contained 31 questions in each part. The first part was about the frequency of use of information technology. Thus, the information obtained is used to collect statistics to assess the use of IT in relation to Word, spreadsheets, application programs, presentation programs, including Google presentations, drawing programs and graphic editors for creating engineering drawings, multimedia and authoring programs, reference books, Internet browsers, e-mail, web page creation programs, special programs for performing laboratory work, virtual learning environment programs, collaboration programs, online generator.

The second part of the questionnaire contained two categories of questions: 15 questions for students and 15 questions for teachers. In addition, it contains five answer options for both groups of questions. The main focus of this category is to determine the use of an integrated educational information system for self-education as an indicator of "purposes of use". The questions in this category define the "purpose of using IT" by assessing the ability of the student and teacher to apply IT systems in different situations with different teaching methods to improve educational technological activities. A section with questions for teachers was developed, to assess their ability, to collect information for planning a training session, compliance with educational programs, access to information and research, creation of multimedia presentations, creating quizzes, keeping records, communicating with colleagues, publishing homework, publication and exchange of scientific student works on the Internet and improvement of computer skills, detection of plagiarism, curricula, involvement in real-time cooperation, helping students to discuss and debate, create multimedia online documents, improve teaching and learning skills, educational strategies, as well as participation in online meetings and classes using brainstorming techniques.

A similar topology is used to develop questionnaires for students.

We used a more simplified version of the survey, compiled on the basis of psychological and pedagogical literature, scientific sources, using elements of the SI IMPACT model, which allowed us to trace the topology of the base of tools and functions of the integrated system to be analyzed. Tools used in IT must perform certain tasks and functions. The programmatic efficiency of an integrated system depends on understanding the value of the tool and its proper use. The questionnaire consists of three sections. All sections are filled in by teachers and students.

We believe that self-education is an important social phenomenon that has historical roots, and the pedagogical process should be perceived as an open world system that develops in different ways and in different ways. The openness of the educational system is considered an innovative characteristic that allows education to adapt to changes in the socio-cultural environment and form an environment of ideal form, or one that approaches the ideal form, which contributes to the effectiveness of self-education [17].

The digitalization of society has a significant impact on the nature of self-education. Adaptive systems of distance learning and knowledge control based on intelligent Internet technologies are an important element of educational systems in improving knowledge and skills in a particular field, which depends on personal activity.

Thus, analyzing the content of the concept of "self-educational activity in crisis conditions" and its structures in pedagogical practice and scientific literature, as well as the strategy of digitalization of society, we propose the following definition: student self-educational activity in crisis conditions is a type of intensive, purposeful activity in an educational environment characterized by a high level of information integration that ensures the availability of quality educational content, the use of various information technology tools to ensure the acquisition of professional.

In the structure of students' self-educational activity in the crisis, we distinguish the following components:

– motivational and regulatory (involves the formation of a system of motives (professional and personal), goal-setting strategies);

– cognitive-activity (involves mastering the tools of information technology to achieve the goal, the availability of skills in information environments);

– control and correction (student's awareness of the effectiveness of self-education activities, ability to adjust goals and organize their own self-education activities).

We consider a student's readiness for self-education as a complex characteristic that includes awareness of the importance of continuous self-education, developed self-study skills, the ability to use information technology to search for and process information, the ability to plan their actions and use time effectively, as well as the ability to self-analyze, self-control and self-evaluation.

In our opinion, the strategic goal of developing readiness for self-education is to familiarize students with a system of ways of doing things, not a system of knowledge or facts. In the traditional approach, the main emphasis is usually placed on the formation of students' information array. Therefore, in the methodology we propose, special attention is paid to analytical activities and methods with a high level of language communication, which makes it possible to discuss, debate, prove one's own position, etc.

In today's information society, the approach to self-education is changing, and self-study is becoming a standard and a necessary component of professional activity.

1.3. Pedagogical Conditions for Forming the Readiness of Students for Self-education Activities in Crisis Conditions

While studying at the university, students can engage in self-education, which involves making efforts and actions to improve their personality through the acquisition of relevant skills. In this process, the student is an active and independent subject of learning, and teachers act as mentors and managers who promote the development of self-education activities. According to scientists, self-education is an organized and personally controlled process that involves planning and performing a certain type of cognitive activity. Therefore, it is important to scientifically substantiate the pedagogical formation of students' readiness for self-education, taking into account the potential of the modern information society.

In the structure of students' independent graphic activity, we distinguish three blocks. The conceptual block consists of methodological approaches in combination with general didactic and specific principles:

– systematic – students' self-educational activity is an integral system consisting of hierarchically subordinated blocks that form a closed cycle of forming a student's readiness for self-education;

– the cognitive-activity – psychological aspect of this methodological principle allows to take into account the influence of activities on the formation of students' knowledge;

– student-centeredness is a modern methodological approach that recognizes the student as the central subject of the educational process with his or her needs and interests;

– environmental – students' learning should take place in a specially organized educational environment that meets the university's educational programs and the capabilities of the digital society.

Specific principles of students' self-education are harmoniously combined with general didactic principles.

1. The principle of communitarianism: determines the organization of cooperation between teachers and students, the choice of a partner for research, joint projects, preparation for classes, etc. In this case, knowledge

about the object as a whole, its properties and structure is more important than knowledge about its individual components. Such knowledge provides an opportunity for discussion, clarification, etc. The components of communicativeness are considered in terms of system-forming links, hierarchical relations and structural and functional characteristics. The Internet space contributes to the realization of this principle by expanding the circle of communication of participants in the educational process.

2. The principle of contextual learning: any type of educational activity has a generalized structure that is subordinated to a certain structure of psychological activity and takes into account the psychology of professional thinking of a specialist.

At the same time, learning activities involve realizing the goal, ways to achieve it, and building an indicative action plan. The possibility of achieving the goal is largely determined by the student's activity.

3. The principle of constructivism: each student has his or her own intellectual development, skills in organizing their activities, and goals for achieving success in professional activities. Therefore, the degree of complexity of the educational process is perceived by each student individually. Accordingly, ideally, an individual learning trajectory should be developed for each student, and in accordance with it, the student can form an individual trajectory of self-education.

4. The principle of optimization and intensification of self-education activities: optimization of educational activities means minimizing the content of academic disciplines and their number in order to save time for their mastering. The principle of integrity of self-educational activity implies the unity of all components aimed at achieving one goal.

Ensuring an appropriate level of independent activity allows a person to be in constant development.

While studying at a higher education institution, students carry out various types of self-educational activities in their chosen specialty, as well as those that are not related to their future profession. Scientists emphasize that the type of self-educational activity contributes to the activation of indicators of mental comfort of a future specialist.

5. The principle of continuity and functional completeness: high-quality educational content based on scientific evidence. In particular, evidence-based content has a significant motivational potential for independent work.

The basis of cognitive activity is the background of theoretical knowledge, so scientific works focus on this aspect of the educational process. Involvement of students in writing scientific articles and participating in research projects requires them to generate new ideas, clearly articulate their own thoughts, perform significant analytical and research activities, and know a foreign language, which now becomes an object of independent activity.

The first pedagogical condition (*the use of an integrated information environment, in particular with the use of blockchain technologies*) involves the implementation of the above didactic principles of information technology-based learning in higher education institutions.

Among educational innovations, blockchain technologies are worth highlighting, as they allow improving the traditional education system. Today, there are 5 educational institutions that use blockchain technologies in the educational process (Melbourne Royal Institute of Technology, National University of Singapore, University of California at Berkeley, Massachusetts Institute of Technology, Hong Kong Polytechnic University). The advantages of blockchain include the following: the possibility of timely publication of scientific materials. The technology also helps in copyright management and piracy protection; easy sharing of educational materials; providing universal access to open educational resources (books, podcasts or training materials), the ability to securely share these resources with minimal financial costs; blockchain technology prevents fraud and changing grades or falsifying educational documents by students. This ensures employers that their applicants have the necessary skills and helps them find the best candidates for the position.

Information technology creates new opportunities for communication. Therefore, content development requires scientifically sound material based on the above-mentioned didactic principles, as well as providing different ways of accessing the learning content, which should be coordinated with the teaching methods. It should also be noted here that it is advisable to choose the following teaching methods that ensure the greatest communication between the participants in the learning process (lecture, explanation, conversation, conversation-message, story).

In the process of language communication, the object-subject model is of great importance for the development of independent activity, as well

as imaginative thinking and communication skills. This model allows students and teachers to play opposite roles. Students independently study the problem proposed by the teacher, draw conclusions and discuss them with the teacher. An interesting recommendation from psychologists is that if a student chooses the wrong path, the teacher should not stop them, because mistakes also play a significant role in gaining experience in independent work.

The organization of independent graphic activity of students involves the use of a special educational environment, which is characterized by a systematic organization, a high level of saturation of information-methodical, technical, educational-methodical support. Such environments have already found sufficient distribution today (educational scientific programs, curricula, work programs of the educational subject, methodical developments, learning technologies, control measures).

The second pedagogical condition is focused on the use of a methodology for the gradual formation of readiness for self-education. In our opinion, the phased methodology of forming readiness for graphic self-education differs from the traditional ones by the full involvement of the student in the learning process based on activity and concentration. The first stage is the formation of motives. If the motive is formed, the second stage can be effectively implemented: determining the right goal and ways to achieve the goals of self-education. The third stage is organizational and controlling. Students need to independently organize and direct their own activities. When using a step-by-step methodology for forming a student's readiness for self-education, the role of the teacher becomes advisory.

The third pedagogical condition (systematic and consistent involvement of students in research work) is also one of the most effective means of developing self-education skills. After all, students need to conduct search work on their own, analyze the source base, establish new facts and justify their scientific value, summarize the results, etc.

Research work of students in today's conditions is a major component of university education. It contributes to the formation of a scientific worldview and personal professional development, develops creative thinking and individual abilities, develops the skills of independent research work, attracts talented young people to the department of research work, promotes the education and training of young scientists.

Students from the first year of study under the guidance of teachers should be actively involved in the scientific component of obtaining an education: become members of research laboratories and participants in conferences, seminars, competitions, projects, festivals of various levels.

Scientific work is the basis of mutually beneficial and productive cooperation between teacher and student. On the one hand, this cooperation awakens the student's interest in scientific work, which often becomes a good incentive for successful studies and a further scientific career, and on the other hand, it can be an important impetus and ideological enrichment for the topic on which the scientific supervisor works.

Wide implementation of elements of scientific research in the educational process enriches the student's knowledge and skills, familiarizes him with the real working conditions in the laboratory, in the scientific team, teaches independence of judgment, the ability to concentrate, thoughtfully and purposefully work on the assigned task. He will need this knowledge throughout his life, in whatever fields of education, science or production he works. In the first year, students should be familiarized with the features and specifics of scientific student creativity, explained, explained how to participate in scientific research work, perform it qualitatively, properly format and present the results in the form of an essay, report or article. In the context of graphic activity, students learn to use graphic information as a means of presenting a creative idea and a tool for finding a solution to a creative problem.

Two forms of scientific activity of students can be distinguished: during the educational process and in extracurricular time.

The forms and methods of involving students in research activities include the following:

– performing tasks with a scientific and creative component in the process of studying professional disciplines;

– mastering the basics of scientific research in the process of studying the discipline of the fundamental cycle (mathematics, physics, etc.);

– creation of educational and scientific structures for extracurricular learning and active involvement of students in club and studio work of scientific and creative direction;

– hearing and discussing the results of students' research at departmental meetings and seminars;

– involvement of students in competitions and contests of various levels;

– involvement of students in the competition of student research papers;

– involvement of students in scientific conferences, seminars, and symposia;

– coverage of students' achievements in the media to popularize research work in the student community.

In addition to studying the theoretical foundations of scientific research, introducing elements of creativity into educational laboratory, practical and seminar classes, academic supervisors highlight practical issues of research work during students' coursework, diploma and master's theses and during their industrial practice.

One of the forms of scientific work in the junior courses is the activity of student scientific circles, which function at the scientific laboratories of the departments on topics related to the areas of research. For this, student scientific circles are created at departments or scientific laboratories. They are formed according to the direction of scientific activity of the department to solve one or another scientific problem under the guidance of a teacher. The student scientific circle unites enthusiasts who master the methods of conducting scientific work, learn to work with scientific sources, prepare scientific abstracts or reports, speak in front of an audience. The participation of student youth in clubs begins with the first year and continues throughout the entire period of study at the faculty. A member of the scientific circle can be any student who successfully mastered the educational program, wants to deepen his knowledge of the specialty and acquire research work skills. Admission is carried out on a voluntary basis based on the student's oral application.

The content of the work in groups and the form of summarizing its results at each department have their own characteristics, but most of them are characterized by the writing of abstracts and reports, their active discussion. Often, students write reports for the first time in their lives, so they are analyzed at a group meeting, the supervisor points out shortcomings, and teaches how to correct them. The best reports are recommended for submission to student conferences and competitions of student scientific works.

Each student in the group independently fulfills the tasks of the scientific supervisor, speaks at the meetings of the group with abstracts, reports and scientific messages. The work of the members of the circle is

evaluated according to the principle: to recommend or not to recommend or finalize for further submission to a scientific conference, competition, grant, for publication in official publications. Evaluating scientific work takes into account the topicality of the topic, the extent of independence in the conducted research. In addition, important criteria are the quality of presentation of the material, i.e. how freely the speaker uses scientific terms, competently presents the material, as well as the quality of the presentation of the work, i.e. whether the work is well illustrated with tables, figures, diagrams, whether there is a logical connection between the illustrations and the presented material. Members of the student scientific circle have the opportunity to develop their creative abilities and achieve certain successes in research work, which gives them an advantage during selection for master's and postgraduate studies.

In the process of scientific activity, both the experience of integrating educational and cognitive and self-educational activities and the self-improvement and self-realization of the subject of learning take place.

A sign of a modern university is an informational educational environment that correlates with the development of innovative technologies. In our opinion, the integrated information learning environment should be considered a harmonious combination of information educational resources, computer-based learning tools, modern means of communication and innovative pedagogical technologies.

The first acquaintance of students with the information learning environment begins with the syllabus and the work program of the discipline. They indicate the amount of independent work during the academic period, the number and nature of tasks, forms of control, and a list of recommended sources. In addition, in these documents, we orient students to the methods that will be used to conduct training sessions and the evaluation criteria. It also guides the student to search for certain information when preparing independently. Therefore, to organize independent graphic training, it is necessary to analyze and select special educational and methodological literature, methodological materials designed specifically for the organization of independent work of students (it is important to pay attention to the choice of reference books on engineering graphics, as it is necessary to constantly monitor changes in standards for technical documentation, standard products, etc.).

The introduction of modern information and communication technologies is considered a priority in the national education development doctrine. Today, computer technologies include multimedia lectures, interactive practical works and programs, test programs, electronic reference books, textbooks, computer games, and applied professional programs. These technologies change the efficiency, accessibility, and speed of knowledge acquisition, promote student initiative, and prepare the younger generation for life in the information society. The principles of multimedia technologies are characterized by acts of simultaneous visual and procedural perception, synthesis and synchronization of verbalized and non-verbalized knowledge, which contributes to the analytical and synthetic activities of the student and the simultaneous synchronization of verbalized and non-verbalized knowledge, synchronization and integration of visual-spatial information, which is the basis of graphic engineering activities. The use of multimedia technologies in graphic training contributes to the development of the creative and intellectual potential of future mechanical engineers. Multimedia systems allow you to choose the desired format of educational material in advance. and the standards of modern media allow not only to store a large amount of diverse information (up to tens of GB), which is extremely important for ensuring the mobility of the educational process, but also significantly improve its quality.

When applying multimedia technologies in graphic training, we offer two directions: 1) work with simulation models and subject-oriented environments; 2) development and use of clip technologies to solve basic graphic problems and develop graphic construction skills. The first direction involves the teacher creating a preliminary model and drawing up problem tasks to find the best solution.

The student's activity requires careful perception and comprehension of the problem, planning the stages of solving the problem, and reproduces the course of the model's research and presentation of the research results. In this case, the role of the teacher can be rather passive, and the stages of research are guided by leading questions. If a student does not have enough skills to work independently, multimedia with appropriate methodological support can provide the necessary assistance. In this case, we are talking about student-multimedia cooperation: the student learns the material independently, but at any time can receive direct instruction,

contextual advice, or recommendations from the computer software's help system or the teacher.

Considering the organizational aspect of the use of multimedia technologies in graphic training, we should pay attention to the possibilities of university educational environments for the methodological work of the teacher.

Having analyzed the best practices of scientists in this field, we have concluded that in the conditions of insufficient number of practical hours for studying graphic arts in agricultural universities and students' interest in using the latest information technologies in the process of studying descriptive geometry, engineering and computer graphics, it is advisable to propose a methodology for the formation of graphic competence, which would include traditional methods of graphic training in combination with new information and telecommunication technologies that provide.

This methodology, which meets all the requirements of modern professional education, is now possible with the creation and use of a technological learning environment at Ukrainian higher education institutions.

Among modern information technologies, a special place is occupied by video technologies, in which clip technologies are now distinguished.

When developing educational clips, special attention should be paid to the careful selection of information in terms of its usefulness for the student and multiplicity. After all, our observations show that the most effective clip duration is 5-15 minutes. We call it the phase of active student work.

The created training clips are available to students at any time via the Internet.

Informatization of education involves the widespread use of new technologies in the learning process. This not only changes the way information is presented, but also has a significant impact on the organization of classes, the system of methodological support, and the organization of the workplace of teachers and students. In this regard, the educational process acquires new, previously unknown features. Among them are accessibility, mobility, and new types of communication between participants in the educational process.

The main direction in the informatization of graphic training is associated with the use of multimedia technologies that are effectively implemented in modern information educational university environments.

Clip-technologies as components of computer-oriented technologies allow organizing both classroom work under the guidance of a teacher and independent graphic training of future agricultural engineers at a qualitatively new level through the use of simulation models for visualization and transformation of graphic models and the introduction of a new generation of methodological support (video lectures, video consultations on solving basic graphic problems and the formation of skills in practical graphic activities).

In this context, we associate the prospects for further research with the study of innovative methodological support in developed countries, the exchange of experience with teachers of leading Ukrainian universities and, on this basis, the substantiation of didactic conditions for the introduction and improvement of clip technologies in the process of graphic training of students.

The high level of abstraction of graphic information requires specific teaching methods. In face-to-face learning, students have a simplified opportunity for individual consultations. We associate the disadvantages of distance learning primarily with the lack of such an opportunity, which requires additional efforts from the student when studying graphic disciplines. A student's readiness for self-education involves a formed motivation to study descriptive geometry, engineering and computer graphics, the availability of skills in independent work with literature, skills in working with graphic editors, the ability to organize their work and work hard. The methodology we have developed for forming readiness for self-education is based on well-known didactic principles: objectivity, scientificity; links between theory and practice; consistency, systematicity; accessibility; and visibility (this principle is extremely important for graphic training). It is proposed to form motives for learning along the following vectors: explaining the dependence of an engineer's professional career not only on the general results of university studies, but also specifically on the level of graphic training; developing a student's inclination and learning ability (during a conversation, encouragement, taking into account the complexity of graphic tasks for each student); and achieving student understanding of the usefulness of the work performed. This requires a psychological adjustment of the student to the importance of graphic work performed both in the context of professional training and in terms of

broadening the horizons and erudition of the future specialist. It is necessary to convincingly show students that the results of their independent work will help them to better understand the lecture material, perform better in subsequent graphic works, etc.

In order to create motivation for independent graphic training, we conduct a SWOT analysis with students. In our case, the SWOT analysis is designed to facilitate a realistic, factual and data-driven view of the strengths and weaknesses of students' learning, particularly in the study of graphic arts. Based on the understanding of the need for graphic training, students need to focus on their own volitional efforts, build individual learning trajectories, focusing on real-world contexts.

The main idea of the author's methodology is the need to individualize learning as opposed to individual work. In order for the process of independent graphic training to become an effective means of forming graphic competence, it must meet the following methodological and didactic requirements: graphic tasks should be applied at all stages of learning; a strict sequence in the transition from simple to complex tasks is necessary; each task should correlate with the topic and objectives of the class, the level of graphic training of students and should be aimed at mastering and consolidating the educational material; all tasks should develop mental and graphic abilities.

When performing graphic tasks, students use graphic editors. The skills of working in graphic programs are formed gradually. Therefore, it is advisable to take this aspect into account when choosing tasks for self-study. For example, depending on the nature of the graphic activity used in solving problems on the basics of design, we distinguish 3 groups of tasks: drawing images, building images from different source data, reading images, changing the number of images. As a simple initial task, we perform tasks with drawing missing lines. In such tasks, the student must first identify the place on the drawing where these lines should be. To do this, it is necessary to analyze the image from the point of view of the geometry of the figures that make up the image. Such simple tasks are extremely important in the further study of engineering graphics, because they promote analytical activity and the development of spatial thinking. Unfortunately, practice shows that teachers make little use of such tasks in the educational process due to the limited number of hours allocated to graphic disciplines.

The task of reading a drawing book should constantly accompany the process of studying graphic disciplines, because it is an integral part of engineering activities. We implement the concept of "reading a drawing" in several aspects: as an independent process, for example, during the tasks of reading working and other drawings, where it is necessary to give a verbal description of the part; as the main component and as a stage of solving projection and graphic tasks on the drawing; as a means of control when building a drawing (when making a sketch, performing design tasks, building a drawing from a description, etc.) Tasks to change the number of images are also extremely important for future engineering activities. Unlike a simple drawing that contains two or three views of a part, there is no need to compare projections to find the characteristic features of the shape depicted in the drawing. The images become defined only by the presence of conventional. Creative tasks occupy a special place in graphic training, because modern engineering requires a specialist to independently transfer knowledge and skills to a new situation; the ability to see an alternative solution; seeing new problems in familiar standard conditions, etc. Designing is a component of engineering activities to create new parts and their connections. Modern graphic training must necessarily contain elements of design, providing a professional context for graphic training. For students, we offer a certain sequence of design tasks: explanation of the device of a given structure and indication of its main parameters (for the agricultural field of study, we choose agricultural machinery). Students develop the design and dimensions of individual parts on their own; transferring the principle of operation of a known design to a given design; filling in the missing link in the design; designing a schematically specified design; designing a part according to specified technical requirements; designing according to their own idea. In order of increasing complexity, the tasks can be offered in the following order: designing elements of parts, designing parts blanks, designing parts, designing assembly units.

Formation of readiness for independent graphic activity involves the development of skills and abilities to read a drawing as a basic activity that requires special training. Thus, it is necessary to develop the ability to represent the three-dimensional shape of an object from its images; knowledge of the conventions and simplifications used in the execution and design of drawings; the ability to give a verbal description of the depicted

technical object in a certain sequence. Special exercises are offered to develop these skills and the ability to read drawings. For each topic, several exercises of the same type, but of varying difficulty, should be developed. This will ensure both the consolidation of the learning material and the work of students based on their individual abilities. During distance learning, we also practice cross-checking graphic tasks by students themselves. This helps to consolidate the skills of reading drawings, which is one of the most important tasks of teaching independent work in engineering graphics. On the other hand, such an organization of independent work contributes to the development of communication skills and the ability to defend one's opinion.

Recently, the methodology of teaching general technical disciplines has undergone certain changes in the organization of the process and methods of teaching, their structure and content. The orientation of Ukrainian universities towards European standards promotes the search for technical information in English. Therefore, it is advisable to link the methods of forming students' readiness for independent work with the study of a foreign language. Thus, today, the most common and effective technology for forming the graphic competence of future engineers is computer-oriented technology, which is designed to ensure the effectiveness of graphic training in a foreign language environment. That is why specialists in the field of computer technology, linguists, methodologists and teachers of technical disciplines and foreign languages have to improve their teaching methods using modern information technologies. Such technologies, by giving students access to non-traditional sources of information, increase the efficiency of independent work, provide entirely new opportunities for creativity, finding and consolidating new graphic skills, and allow for the implementation of fundamentally new forms and methods of teaching, which undoubtedly has a positive effect on the effectiveness of learning.

The suitability of modern computer technologies for use in classes in technical disciplines taught in English is determined by the following criteria:

a) contributing to the increase of labor productivity and efficiency of the educational process;

b) ensuring control of the learning activities of each student;

c) increasing interest in the study of a specific general technical discipline and the English language;

d) providing prompt feedback and operational control of the actions of all students;

e) the ability to quickly enter answers without lengthy coding or encryption.

When teaching graphic disciplines in English, the didactic principle of visibility takes precedence. Students' learning activities should be carried out in the maximum possible modality of the learning material. Only those means should be used that maximally contribute to the realization of the learning goal, identify and emphasize the most important aspects, abstracting from the currently irrelevant ones.

The most important advantage of computer-based learning tools is based on the modern understanding of the principle of visibility and is that when using pedagogical software tools, students not only observe learning situations, but also participate in them. In this way, the essential didactic prerequisites for learning success are realized: emotional involvement, gnosticism, visualization of educational material, and individualization of the pace of presentation of educational material.

When presenting educational information in terms of compliance with the principle of visibility, presentations are unconditionally preferred. Presentations in teaching English have a clearly defined structure. First, the formation of a vocabulary thesaurus.

It should be noted that it is important not only to translate technical terms, but also words of the social and everyday level that ensure coherence, logic and systematic presentation of technical information. When using "dictionary" slides, it is necessary to ensure not only visual perception of words as a sign system, but also listening and memorization. For this purpose, students are offered frontal repetition of words, direct and reverse translation of short terms. Only the frequency of repetition ensures understanding of technical information that must be perceived by ear. Observations of the learning process allow us to state that only in the third lecture (if there is no prior special training) students begin to focus on understanding the content of the educational information rather than on translation.

Understanding the content of technical information in English is facilitated by the principle of active involvement of all students in the learning process. This principle requires the teacher not only to engage

students in active work during the lecture. It is also important to make them aware of the need for their own activities and to give them the opportunity to choose the types of activities that best suit their own abilities. The teacher creates an appropriate guiding framework by formulating criteria for selecting the most rational activities.

In graphic arts, the most difficult mental operations are abstraction, comparison, and modeling of technical objects. The principle of visibility allows you to simultaneously provide contextualized information, which facilitates the course of thought processes.

The use of presentations with a gradual complication of detail elements, the possibility of independent activity at the lecture and self-control of such activity shows an unconditional positive effect.

When using slides for independent work of students, the possibility of self-control and control over the execution of graphic images is an urgent need. Therefore, such presentations are made with simultaneous work in graphic editors (AutoCaD and others). It should be emphasized that graphic disciplines are studied in the first years of university and involving students in creating the graphic part of presentations plays a big role in motivating them to acquire practical skills in working with graphic editors. It is appropriate to focus on the editors that are most effective in creating methodological graphic support.

We should start with PaintBrush, which comes standard with Windows. Most students begin to learn the basics of computer graphics with this program, which is very simple and easy to learn without any special skills. This editor allows you to create the simplest geometric shapes, draw lines of various widths, and type text. At the same time, all created objects can be edited: resized, rotated, copied from one place and pasted to another, and changed color. Working in this editor provides good training for mastering more complex professional packages. Students do not have any difficulty learning this program.

CORELDRAW Graphics Suite X3 is a relatively new graphics package that greatly simplifies the work on projects of any scale, from logo design, creation of a professional marketing brochure to a bright and catchy poster. CORELDRAW Graphics Suite X3, unlike other similar graphic products, combines high functionality in solving a variety of graphic design tasks, high speed, ease of use and affordability. CORELDRAW Graphics Suite

X3 includes: vector graphics editor CORELDRAW X3; raster graphics editor HOTO-PAINT X3; application for working with images in Raw Pixmantec RawShooter; program for creating screenshots Corel CAPTURE X3; e-book on working with the CORELDRAW Handbook. CORELDRAW Graphics Suite X3 contains more than forty new and improved options. The most widely used in professional graphic activities, in particular engineering, is the Autodesk AutoCAD graphic design program. Autodesk autocad is designed for two- and three-dimensional design. CAD in the name of the program indicates involvement in CAD systems (computer aided design). Autodesk AutoCAD is a convenient and popular program. It is a leader in computer-aided design systems.

Designers and other professionals in the field of computer graphics are provided with fantastic opportunities by the undisputed leader among graphics packages – Adobe Photoshop, recognized by professionals and amateurs alike. Observing how Adobe Photoshop has grown from its birth to become a powerful image editor, one can be amazed that the developers have managed to keep the program simple and easy to learn. While other programs become more and more difficult to master from version to version, even a casual user can launch Photoshop and perform simple operations without practice. However, the most widely used, particularly in agricultural universities, is the AutoCAD graphics program with quite powerful features. It has been used for a long time and is well described in scientific and pedagogical research.

The frequency of terminology repetition implies the systematic presentation of educational material, which is associated with the provision of prerequisites for the student to create a personal model of knowledge, which should be an internally consistent system, meet the purpose of learning, that is, be as adequate as possible to the pedagogical model of knowledge. In the content of this approach, it is advisable to distinguish a new component – a method of implementing learning activities, during which knowledge is acquired. And in order for students to have a system of ideas about the graphic activity to be performed from the very beginning: it is necessary to give general guidelines at the beginning of training, that is, to create an orientation basis for actions.

Internet users have access to all the world's leading educational websites, which, unlike their paper counterparts, are constantly updated and edited

and therefore contain the latest information. Using materials from English-language educational sites allows you not only to listen to and work with original texts, but also to find differences in standards, in particular for graphic disciplines regarding projection systems.

Based on the above, planning classes in technical disciplines in English using multimedia can be divided into 4 stages:

Conceptual stage. At this stage, the didactic goal is determined with a focus on achieving the following results: formation, consolidation, generalization or improvement of knowledge; formation of skills; control of learning, etc.

Technological stage. Based on the formulated requirements for the lecture in terms of didactic goals and methodological purpose, their multifactorial analysis and selection is carried out. The level of complexity of the educational information in English is also selected. In addition, a more detailed analysis of the electronic resource is carried out. It is at this stage that the teacher determines the necessary methodological support).

The operational stage. At this stage, the main structural elements of the lecture are identified, the ways of interaction between different components and their functional interrelationships are selected. At this stage, the functions assigned to multimedia are detailed, as well as the choice of ways for students to interact with electronic devices. The lecture is planned step by step, and for each of its stages, the purpose, duration, form of organizing students' activities, teacher's functions and main activities, form of intermediate control, etc. are determined.

Pedagogical implementation. The main goal of this stage is to put theory into practice. To effectively manage the multimedia-based learning process, two main tasks need to be solved. The first is to determine the psychological state and level of knowledge of students. The second (the task of managing students' cognitive activity) is to plan and implement an optimal sequence of actions that ensures the acquisition of the necessary knowledge in the shortest possible time or the maximum amount of knowledge in a given time.

Based on the goals of higher education and its pedagogical tasks, the need to create new methods for teaching general technical disciplines in English at higher education institutions can be argued by the lack of sources of educational material; the possibility of presenting information materials in multimedia form to achieve clarity; the need for visualization of the

phenomena, processes and relationships between objects under study; the need to develop skills and abilities of information retrieval activities; creating conditions for the effective implementation of.

The main purpose of involving students in research is to develop methods, techniques, and skills in research, design, and development work, as well as to develop abilities and readiness for innovation. After all, modern engineering is in dynamic development. The involvement of students in scientific activities should be based on scientifically sound principles, taking into account the psychological foundations of engineering creativity. Let us briefly summarize the main provisions of engineering creativity that must be taken into account when organizing student research.

The creativity of an engineer has a certain structure and stages of development determined by this structure. The structural elements of engineering creativity are: reflection and comprehension of the treatment of a technical need as a problem of technological progress; creation of a new technical idea; development of an ideal model of a technical device; design – transition from an ideal model to the creation of a new technical device based on mathematical and technical calculations; creation of a new industrial design.

The following stages of creative engineering activity are distinguished. The first stage is a critical reflection on the existence of the actual state of a technical problem based on experimental materials and logical reasoning, and the formation of a problem situation. The result is the formulation of a specific technical task that can become the basis for further creative research.

The second stage is the stage of "birth" and gestation of a new technical idea as a result of creating a new idea to solve a certain technical problem. It is not yet a technical invention or an ideal model of the new, but it is a way beyond what exists at the moment. To this end, a set of methods for finding something new is used. At the same time, rational methods, which form the logical basis of the process, do not exclude the use of some imagination and intuition when creating a technical idea.

The third stage is the stage of developing the imaginary reality of an ideal model as a result of schematization of a new technical idea, as a structural and functional diagram of a future technical object. The ideal model expresses the active creative activity of the subject, taking

into account. Next, the technical idea is materialized, and the future object is built in a specific material form. At this stage, the process of substantiation, refinement, and creation of a sample of the future technical object takes place.

The fourth stage is the design stage, the transition from mental construction to actual development. The results of the design are expressed in preliminary and technical designs, in working drawings or models. The contradictions between the material and the ideal, theory and practice, begin to be resolved. There is a movement from an invention in the form of an ideal model or patent to working drawings and specifications and then to working models and experimental designs.

The fifth stage is the stage of embodiment of the invention in a new technical object. This stage consists of a number of stages. At the initial stage, an experimental model is created, which makes it possible to refine the design and technological developments on the basis of the experiments. Then, an industrial prototype is created to test the experimental model in industrial conditions. Finally, the new equipment and technology is put into serial or mass production. At this stage, the process of resolving the contradictions between theory and practice is completed, but new technical challenges and new contradictions arise.

As you can see, all stages of engineering activity are associated with creativity. The creative nature of an engineer's activity is manifested primarily in the fact that this activity is socially oriented. After all, an engineer forms the purpose of his or her activity based on the understanding of the technical needs of production and society as a whole. The purpose of technical creativity is to meet the realized technical needs of society. Problems arise and are formulated with the beginning of the realization of a certain goal. Setting a goal in creative engineering activity is a complex dialectical process that reflects the reality of the present and the needs of the future. The goal arises due to the human ability to imagine, to represent a real material technical object on the basis of an ideal image. Engineering creativity realizes going beyond the current state of engineering and technology.

The creative nature of an engineer's activity is manifested at all its levels: inventions, engineering solutions, implementation and operation of new equipment and technology, etc.

The creative activity of an engineer, which leads to inventions, differs from everyday production activities, when the found technical solution is only repeatedly reproduced. Invention is an act of consciousness that leaves behind traditional engineering activities and creates a new one. In its tendency, invention is opposite to nature as the artificial is opposite to the natural.

It is impossible to draw a strict line between an invention and a discovery because they are both the result of the same thought process of the subject. Because of this interconnection, it is difficult to determine whether an invention or a discovery has been made in a particular case. Often, both have the same psychological mechanisms and are merged in one research process, or one of them creates the preconditions for the other.

The process of invention goes through certain stages: problem formulation, analysis, solution, and critical analysis. These three criteria are used to evaluate what is new in the process of technical creativity.

The technical problems that arise in a particular production facility or in a particular technical field pose certain technical challenges to engineers. For example, problems with energy and its impact on the environment define the task of finding and practically using new energy sources. Contradictions between technical tasks and the possibility of solving them with existing means give rise to the technical problem of creating appropriate technical devices.

In this case, an engineer must formulate a specific technical problem in such a way that it implicitly contains a specific technical idea for solving this problem. Through the complex and sometimes quite lengthy process of designing and then constructing, the right solution to a technical problem is found. An engineering solution is a solution to practical technical problems that is creative in nature, realized not only in certain technical samples but also on the scale of social production. The final engineering solution must have a scientific basis and take into account the accumulated production experience. In the process of creating an engineering solution, the engineer's creative potential is fully manifested and realized, and his or her activities are of a pronounced innovative nature. However, it is important to carefully coordinate the creative approach with the requirements and norms of standards.

A prototype is brought to an industrial design and a serial product through a production experiment, which links science to production. A large team of

scientists, engineers, technicians, and workers is required to make changes to the prototype, improve it in accordance with the production process, and organize this work. Modern engineering is characterized by the fact that it becomes the prerogative of a large team of people who complement each other. After all, there is no one person who knows everything and can do everything necessary. But it is possible to have all the necessary specialists in the team to solve a technical problem. This is the reason for the formation of problem laboratories.

Technical inventions are always part of an evolving process, which is why they involve a large number of people. In some cases, a few inventive acts become the impetus for further inventions. In other cases, invention is limited to existing improvements to inventions already made. The collective nature of creative engineering activity is already evident in the definition of the goals and objectives of this activity. Technology itself does not generate goals. The goal of engineering development is set by people and in most cases is collective. Not only the goals and objectives of the invention process, but also the technical decisions in the implementation of the invention are made by a large team of design engineers, constructors, technologists, and designers. Moreover, the creative process of engineers involves the activities of economists, psychologists, ecologists and other specialists. However, the collective nature of the activities of all these participants in the inventive process is even more evident in the operation of the created equipment. In the process of operating the equipment, workers involved in production join the activities of engineers.

Let's pay attention to another specific aspect of engineering creativity. Given its collective nature, there are problems not only in organizing the inventive process, but also in determining the share and appropriate remuneration of individuals involved in this process. This creative share should be clearly defined and determined, since material reward plays a crucial role in motivation.

The creativity of individual engineers is not diminished in its importance, but only stimulated by the creativity of the entire team. This is a qualitative feature of engineering creativity that distinguishes it from other types of creativity, such as creativity in literature or art.

Thus, engineering activity is an activity in the field of material production that has a technical orientation. It is aimed at transforming the natural into

the socially significant in order to meet certain human needs, which is why engineering itself appears as an opportunity for the development of society with the help of human consciousness. Engineering activity accumulates production experience and uses scientific knowledge, is characterized by a high degree of intellectual creativity, takes place mainly in the social environment and depends on external, socio-cultural factors.

The value of technology is always correlated with the progressive goal of social development, with the realization of human creativity, so the technogenic approach to modeling technology is inherently inhumane, since it takes into account human needs but does not take into account human capabilities. This approach is opposed to another, humane approach to technical modeling, which takes into account the social conditionality of creating new equipment and technology.

All the complexities of engineers' creative activity cannot, of course, be reduced to social determination alone. But it is also impossible to separate this creative process from certain socio-cultural circumstances. In the process of engineering creativity, the logical and psychological properties of the consciousness of the subjects engaged in engineering activities play a huge role, in particular, the so-called anticipatory consciousness, the ability of human consciousness to determine the future.

Thus, the process of technical creativity itself is an expression of the intellectual potentials of the individual, but its implementation and the meaning of this creativity are influenced not only by technological, but also by economic and socio-political factors. That is why many results of technical creativity have not found their practical implementation and public recognition for a long time, having not received social and practical demand.

The systematic involvement of students in research activities has a significant potential for organizing independent graphic preparation. However, most students do not realize the importance of research. According to our surveys conducted in the first year, on average, 60% of students do not understand the need for research during their studies at the university and have no desire to participate in research. That is why research, as an important part of training a competitive specialist, should occupy a leading place in the learning process. Involvement of students in research in the first years of study shortens the period of adaptation to scientific work. This task

can be solved if students are actively involved in various forms of research conducted by departments and faculties from the first days of their stay in higher education.

Engagement in research requires systematic training of students to use their time rationally. Short courses on time management are appropriate here. For a rational combination of academic and research activities, homework can be replaced by research projects (for example, replacing a course project with a relevant research paper). It is necessary to inform students about the scientific activities of departments, faculties, and scientific competitions offered by the Ministry of Education and Science of Ukraine and other organizations.

In 2022, an experimental study was conducted to test the effectiveness of the model of students' self-education. The research work consisted of three stages: stating, formative, and analytical and generalizing.

At the ascertaining stage, the literature, practical experience, criteria, levels and indicators of students' self-educational activity were studied. A total of 102 second-year students took part in the ascertaining experiment. At the beginning of the experiment, the initial level of students' readiness for self-education was also determined.

To form the control and experimental groups, the academic performance of the respondents and their average grades for the first year of study were taken into account. The average scores were calculated and compared. We evaluated self-education activities according to the criteria listed in Table 1.

In accordance with the above criteria, three levels of self-education activities were identified, as shown Table 2.

In the course of the formative experiment, several stages of independent activity can be distinguished, at which specific forms and methods of learning were proposed.

The first stage can be conditionally called preliminary to what the student wants to learn. Therefore, it is necessary to clearly define the learning objectives. The second step is to identify resources. Next, you need to figure out how the student will receive information. What resources will work? Which ones are reliable and based on facts, and which ones are purely subjective and have no scientific research or evidence to support them.

Table 1

Criteria for evaluating students' self-education activities

Criterion	Indicators
Motivational-targeted	Motivation to learn can be both external and internal. A student can be motivated to study by an external reward, such as a good grade, an interesting job, or even a promise. Motivation to learn is rooted in many factors, many of which can be controlled.
Information and activity	To increase motivation to study, it is important to have a realistic goal. For example, a goal to get a higher GPA than other students will be more motivating than a vague goal: "I will do my best".
Control and resultant	Taking responsibility for your own learning is extremely important when it comes to motivating yourself to learn. Realizing that you are in charge of what you are learning can help you get started, and also help you continue learning when other factors distract you. And thus, to adjust your learning outcomes.

Source: authors' own development

Table 2

Levels of students' readiness for self-education

Level	Characteristics of the level
Low level	It is characterized by the absence or temporary motivation for self-education and development, cognitive inertia; the student is not able to independently master new concepts and terms; partially performs reproductive actions; does not try to correct mistakes, occasional interest in learning; minimal independent activity. This level is characterized by situationality, lack of purpose in all educational activities
Middle level	It is characterized by the fact that the student begins to form a motivational and value-based attitude to independent work, but the motivation is random and occasional. The student is not able to apply knowledge independently in performing new practical tasks; focuses on typical tasks, sometimes performs tasks according to an algorithm; is able to master new educational material only under the guidance of a teacher
High level	It is characterized by the formed need of students for self-education; the desire to acquire new knowledge, skills and abilities; conscious planning of actions to perform practical tasks and solve them in the most rational way; readiness for innovative activities. The motivational component is based on the intrinsic motives of the individual. Students show cognitive motivation, strive to constantly engage in self-education activities.

Source: authors' own development

It is mandatory to compile a list of resources, for example:

– YouTube;
– Documentary films;
– E-books;
– Books;
– Podcasts;
– Audiobooks.

Before continuing to work independently with sources, it is very important to check the reliability of the information. You can advise students not to dive into a podcast or book if the author does not base his or her arguments on factual data. Authors demonstrate their credibility in different ways, so you need to look for anything that confirms it.

Taking notes will help students to get rid of guessing about something because the student is sure that everything they need to know is written down. It also makes students interact more with the content.

The next step is to review what you have learned.

When a student reviews what they have learned, they should look for two specific things: possible patterns or themes in the book (to highlight the main points) and leading questions or comments that remain to move forward.

And finally, applying what you have learned. Independent work is a personal experience, and it will benefit students if it is done consciously.

During the experimental work, observations were made of students' current grades, as well as the results of the winter (2022–2023) examination session. Statistical processing of the results in the control and experimental groups was carried out using the Excel program.

During the experimental work, we observed the dynamics of changes in indicators of readiness for self-education of students in the experimental and control groups. We can state that in the EG there is a clear tendency to a significant (almost 2 times) decrease in the indicators of low level of formation by all criteria, including the general one, and a tendency to a significant (almost two to three times) increase in the indicators of high level of formation of students' readiness for self-education by each criterion, which confirms the effectiveness of the proposed model and pedagogical conditions for its implementation.

Conclusions

As a result of the study, we came to the following conclusions.

1. Self-education is a sign that a future specialist does not just perform traditional tasks, but cares about his or her overall development as a professional. This suggests that time free from university studies should be spent on self-education. The growth of a future specialist is only possible if traditional learning schemes are destroyed and students are encouraged to leave their comfort zone. In times of crisis, its characteristic feature is intensity.

2. We consider self-educational activities in crisis situations as a type of intensive, purposeful activity in an educational environment characterized by a high level of information integration that ensures the availability of quality educational content, the use of various information technology tools to ensure the acquisition of professional competencies.

The structure of self-educational activity includes the following components: motivational and regulatory, cognitive and activity, control and correction.

3. The developed model of students' self-educational activity in crisis conditions has a complex structure and consists of the following components: target, conceptual, content and technological, diagnostic and effective. The pedagogical conditions for the implementation of the model of self-educational activity of students in a crisis are determined: the use of an integrated information environment (in particular, blockchain technologies); application of the methodology of phased formation of readiness for self-educational activity; systematic and consistent involvement of students in scientific work.

4. The results of the experimental work confirmed the effectiveness of the model of self-education of students in crisis and the pedagogical conditions for its implementation.

This study is not exhaustive. Further work is aimed at developing a technology for self-education.

Prospects for further research. Higher education in Ukraine is in a state of constant development and transformation. The lines of its strategic development are focused on joining the European Education Area, modern information technologies, and prioritizing human needs in modern society. However, since 2020, Ukrainian higher education has faced significant challenges.

The pandemic and Russian aggression have created particular difficulties in the development of modern higher education in our country. During the Covid, the main problem of university education was associated with ensuring quality distance learning and control over learning. Given the state of training in the crisis conditions faced by higher education in Ukraine, it is important to use the potential of self-education during students' studies at the university. We associate the prospects for further research with the development of web resources to provide independent graphic training for future engineers.

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