

**PEDAGOGICAL CONDITIONS OF PROFESSIONAL TRAINING
INTEGRATION OF SPECIALISTS IN AGRARIAN SPHERE**

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Abstract. The research subject is future agrarians integrated professional training. Research methods: systematic references analysis; concept research; modeling; pedagogical experience generalization; scientific investigation, data analysis, discussion, students survey, diagnostic testing methods; qualitative and quantitative analyses of research results. The research purpose is to justify the pedagogical conditions for improving the integrated vocational training quality of students and to formulate the specified goals for future agrarians vocational training. It is proved that one of the promising ways for improving the training of specialists by approaching European standards is pedagogical integration. That is why interdisciplinary links of an integrative nature between the four cognitive blocks: social; mathematical; natural; disciplines related to the main branches of agriculture (crop production, animal husbandry, agricultural mechanization) are inserted into the content of training future agrarians. It is proved that under these conditions social, mathematical or professionally-oriented disciplines function as system-forming factors. The pedagogical conditions for the social, natural-mathematical and professional-oriented disciplines integration are considered as a set of interrelated circumstances of the pedagogical process necessary to create a complete training, which implementation provides training of highly qualified specialists at the lowest cost. The article describes using multimedia experience in professional training. Multimedia learning principles are considered. The possibilities of e-textbooks as a means of effective learning in

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traditional and innovative education systems are also analyzed. Didactic requirements for the creation of this teaching tool are defined. Electronic textbooks “Higher Mathematics” and “Political Science” are presented. The introduction necessity of educational mixed and distance forms in the specialists’ professional training, according to the current social needs is justified. The interaction and integrity problem of three components such as organizational forms, didactic process and qualification of teachers is considered. The conclusion concerning the training process optimization is made, based on the undertaken generalization. The pedagogical conditions analyses for improving the quality of professional training of students allowed to formulate their main groups, such as the following: natural-mathematical, social and professionally-oriented knowledge of agricultural profile system formation on the basis of an integrative approach; problematic approach to structuring the content of education usage; information and communication technologies and multimedia means usage; formation of individual educational tendencies on the basis of educational mixed forms; distance learning introduction; focusing on the synergetic paradigm of education, which is closely related to the integration and systematization processes of the content of education, its accessibility. The research enabled to formulate the certain goals of future agrarians professional training and ,namely to master their general and special knowledge, the ability to adapt professional knowledge to the agricultural education requirements; to ensure continuity in the study of general and professionally-oriented disciplines of agricultural profile; integration of natural-mathematical, social and special agricultural knowledge and skills in professional activity; creative abilities development of agrarians on the basis of integrative, problem and activity approaches in educational process.

1. Introduction

Qualitative changes in social values and needs, significant changes in the political life and economy of the country, the growth of complex research in the scientific field, the integrative nature of production, the growth of knowledge-intensive technologies have led to new training requirements.

The diversity and openness of the economy, the variety of management forms are typical of the agro-industrial complex of Ukraine nowadays. This encourages the growth of mobility, the professional activities of specialists

creative initiative in all agricultural sector specialties, which, in turn, leads to the introduction of innovative forms, methods and content of training future professionals for professional activities. The specialists training in the agro-industrial complex is currently the subject to new requirements, one of which is the formation of such thorough knowledge that would maximize future agrarians intellectual development, the holistic system development of knowledge focused on the future agrarians' skills mastering, inclinations, preferences, social, national and professional maturity.

New approaches to training specialists that meet the above mentioned requirements are revealed.

Scientific novelty: pedagogical conditions for improving the integrated professional training students quality are theoretically described; the certain goals of future agrarians professional training are formulated; distance and mixed forms implementation of training on the basis of certain pedagogical conditions is demonstrated.

Study objectives:

1. Outline the problem of future agrarians professional training.
2. Analyze the main trends in the training process.
3. Formulate the certain goals of future agrarians professional training.
4. Identify the main cognitive blocks of disciplines in the process of training.
5. Establish interdisciplinary links of an integrative nature and determine the system-forming factor.
6. Define pedagogical conditions for the quality improvement of integrated vocational students training.
7. Develop and implement methodological materials in the practice of training specialists in mixed and distance forms.

Research methodology: systematic analysis of literature; research of the conceptual apparatus; modeling; pedagogical experience generalization; observation, data analysis, conversation, testing of students, diagnostic tests method; qualitative and quantitative analysis of research results.

Problem formulation. At present, educators are faced with the primary requirement to improve the quality of vocational education that would satisfy the current needs of society and be competitive in the global labor market.

The coronavirus pandemic has led to distant training implementation. The higher education system has entered a period of fundamental change,

characterized by a new understanding of the educational goals and values. New conceptual approaches are aimed at the use of new learning technologies and continuity of education. The objective trend of higher education institutions is to reduce the number of classroom hours and increase the share of students' independent work, non-formal and informal education. The role of the teacher in the educational process is also being transformed. The teacher's function as the main source of information is gradually losing its relevance, the teacher becomes the organizer, consultant, leader and expert of independent work of students. It requires the search for effective learning tools that would perform the following functions in the learning process: informational, formative, systematizing, controlling, motivating. Implementation of these tasks is impossible without the use of informational methods and tools.

Modern information and communication technologies are increasingly entering the educational process of higher education, becoming almost its main system-forming component that determines the educational development direction. Therefore, the priority of current education is the introduction of modern information and communication technologies that provide further improvement of the educational process, accessibility and effectiveness of education, training future professionals for professional activities in the information society.

Among the recommendations of the Second International Congress of UNESCO on Technical and Vocational Education, aimed at its advanced development, identified the introduction and active use in practice of new information technologies in educational processes.

On the other hand, young people adapt easily to the development of informatization. Due to informational technologies, modern youth perceives the universe in a new way, strive for knowledge, education, culture, creativity and work.

At the same time, these trends affect the system of higher agricultural education in Ukraine. Research and teaching staff must be able to competently select and apply exactly those technologies that correspond to the content and objectives of the study of a certain discipline, taking into account the individual characteristics of students.

With the transition to distance learning, electronic resources have created significant competition for print media, there is a problem of interaction

between traditional textbooks and information and communication technologies. Thus, questions are arisen about the status of the textbook in general, and the limits of the use of one or another form of its implementation in the form of a printed publication or multimedia educational content.

As information technology developed, new forms of information were presented. This was reflected in the content. In addition to texts and illustrations, educational content included multimedia fragments. Undoubtedly, the variety of forms of information presentation has provided new opportunities for educational resources. At the same time, this diversity has created problems related, for example, human perception limitations and special skills availability in the multimedia resources usage. The solution of these problems is hindered by the distance forms of education introduction as one of the areas of modern higher education reform and development. Therefore, information support for distance learning is one of the trends in the future professionals training. At the same time, there is the question of improving the content of traditional and developing new methods, forms and means of teaching.

Requirements are taken / into account in the result of recent reforms in Ukraine's higher educational system. Researchers raise current issues of ensuring the quality of education that would meet European requirements, but primarily adapt the Ukrainian labor market [1; 2; 3].

2. Theoretical and methodological bases of professional training integration of special-ists in agrarian sphere

Based on the approaches study of the specialists training content in agricultural higher education institutions, we have identified the following four cognitive blocks: social; mathematical; natural; disciplines related to the main branches of agriculture (crop production, animal husbandry, agricultural mechanization). By social and natural-mathematical training of an agricultural specialist we mean students' results mastering a specially selected set of elements of social and natural-mathematical knowledge, skills, abilities and values necessary for successful implementation. professional activity in the field of agriculture. We interpret professionally-oriented training as a set of disciplines that develop and supplement fundamental courses, the content of which significantly shapes the future specialists' readiness for their future professional activity. We have identified various

interdisciplinary links of an integrative nature between these blocks of disciplines. The specially fulfilled research enabled us to conclude that under above mentioned conditions, social, mathematical or professionally-oriented disciplines serve system-forming factors. Only social disciplines give the structural understanding, history and society development, and mathematically operate abstract concepts that are concretized in other disciplinary blocks. Vocationally oriented disciplines play an intermediate role between these two blocks and vocational training and act as a cross-cutting educational content component.

This gave us the possibility to formulate certain goals of future farmers' professional training, and namely, their general and special knowledge improve-ment, the ability to interconnect professional knowledge with the agricultural education requirements; ensuring continuity in the study of general and professionally oriented disciplines of agricultural profile; integration of natural-mathematical, social and special agricultural knowledge and skills in professional activity; development of agrarians' creative abilities on the basis of integrative, problem and activity approaches in educational process.

The integration of social, natural-mathematical and professionally oriented agrarians' training is a process of preparation and readiness to perform professional tasks that require integrated knowledge application, methods, apparatus of social, natural-mathematical and professionally-oriented disciplines.

After having studied and analyzed key concepts, we understand the pedagogical conditions for the integration of social, natural-mathematical and professional-oriented disciplines, as a set of interrelated circumstances of the pedagogical process that are necessary to create a holistic training.

The pedagogical conditions analysis for improving the professional training quality of students encouraged us to formulate their main groups:

- natural-mathematical, social and professionally-oriented knowledge of agricultural profile on the basis of an integrative approach formation system;
- problematic approach use to the content of education structuring;
- use of information and communication technologies and multimedia means;
- individual educational trends formation on the basis of educational mixed forms;

- distance learning introduction;
- the educational synergetic paradigm focusing, which is closely related to the integration and systematization processes of the educational content, its accessibility.

These pedagogical conditions are based on the following system-forming ideas of agricultural training integration: orientation on the educational synergetic paradigm; providing learning motivation; students` personal development realization. The above mentioned pedagogical conditions require detailed analyses.

3. Substantiation of pedagogical conditions of integration of professional training of specialists

So, one of the pedagogical conditions is the system of natural-mathematical, social and professionally-oriented knowledge of agricultural profile formation on the basis of an integrative approach.

Based on the integration term of training analysis interpretations, we have identified its procedural and effective components. We understand the integration effectiveness in professional training as a systematized set of knowledge, skills, abilities, creative experience, formed on the basis of the above mentioned blocks of disciplines, their focus on forming a future specialist holistic picture of the world, systematic thinking , the ability to solve professional problems comprehensively, to consider phenomena through all existing prisms. In other words, integration is a way to combine the necessary knowledge, skills, abilities of different disciplines, creative activity, its importance fo future farmers formation. From the procedural point of view, such processes involve forms, methods, teaching aids integration, which leads to solve professional problems as a system object with a focus on future prospects.

Since the training process is a complex nonlinear system, firstly, it is necessary to identify and characterize the integrative system-forming factors that will help to implement integration ideas more effectively.

The systematic approach implementation to the natural-mathematical integration, social and special training in agricultural institutions of higher education involves the following steps implementation: regulations analyses; directions of economic activity of agricultural enterprises study in relation to the training specialists purposes; elements analyses of the educational

content, involved in integration disciplines; establishing links between the elements of these disciplines, determining them; forms definition, methods, their demonstration means; training integration technology development; reveal the dependence of the installed system on external conditions; the quality of training assessment, which has an integrated nature.

Thus, the systematic assimilation of many facts, concepts and judgments in the study of natural and mathematical and social sciences by students is in accordance with the logical connection and rational knowledge continuity in professionally oriented disciplines, reflecting the training logic. Such knowledge integration is the basis for the holistic system of professionally significant qualities of the future specialist formation.

Using a problem-based approach to structuring learning content based on the ideas of interdisciplinary integration.

Problems in learning are the most necessary means of developing productive logical thinking, which can improve the quality of training for agriculture.

Problem-based learning is often offered to ensure professional learning motivation. This approach allows you to highlight the needs and interests of the individual, to develop tasks that most fully reveal each student's potential.

In problem-based learning process, true integration takes place, because we are not dealing with the knowledge superimposition of each other, not with their usual increase, but with their transformation and the emergence of psychological tumors in humans' basis. A number of scholars derive such a pattern of pedagogical integration levels as the relationship between the problems of learning level and its subjects integration: the higher level of problems of the educational process, the higher level of integration of those who teach and those who are taught.

Thus, the natural-mathematical, social and professional-oriented disciplines integration in the specialists' training in agricultural institutions of higher education due to the problematic way of learning gives new features to the educational process, which is a significant factor in forming professional motivation that meet all regulatory requirements for a modern specialist.

Currently, the pedagogical process priority of higher education is the information use and communication technologies and multimedia tools:

the electronic learning tools introduction (textbooks, manuals, catalogs, dictionaries, etc.), computer training programs; the knowledge rating system assessment introduction; the knowledge assessment objectivity increase. One way to solve this problem is to use the multimedia support possibilities in higher education.

The modality principle. It is based on Mayer's double coding theory: information that is presented both verbally and visually is better remembered [4].

The spatial communication principle. Students perceive information better if the words and relevant pictures are presented on a page or screen side by side, rather than separately from each other.

The temporal connection principle. If the words and the corresponding visualization are presented synchronously, not sequentially, it contributes to better learning.

The multimedia use in lectures allows you to create a visual series that helps to increase the pace of the material presentation. Multimedia allows you to use encoded information not only in the form of tables, diagrams, charts, figures but also animations. This allows students to show the dynamics of processes clearly that are difficult or even impossible to demonstrate with chalk and blackboard.

Multimedia technologies proper use in the educational process undoubtedly leads to faster understanding and new information assimilation. An example is the electronic manuals introduction [5; 6].

According to experts [7], multimedia technologies can increase 2-3 times the learning material rate, as they allow syncretic learning, simultaneously involving visual and auditory perception material, actively participating in the management of its supply, the ability to return to those sections need re-analysis.

The authors have extensive experience in the multimedia in natural sciences and mathematics use. All of them are created according to a single logical scheme.

The content of lectures in the form of an electronic manual and visualization of lectures in the form of presentations in the Pauer Point program using the mathematical package MathCad.

Practical classes methodical support, which is in the discipline card in the university network "Socrates" and contains: tasks to solve in class and homework, modular control individual tasks, training and testing tests.

Modular and final test control in the Tezaurus system.

The multimedia use in lectures allows you to create a visual series that helps to increase the material presentation pace. Multimedia allows you to use encoded information not only in the form of tables, diagrams, charts, figures but also animations. This allows students to show the dynamics processes clearly that are difficult or even impossible to demonstrate with chalk and blackboard. We widely use the MathCad system when preparing multimedia materials. This is due to the fact that if the graphic or audio information can be presented in the form of an array, then in the future for its processing you can use all the possibilities for processing MathCad data arrays (Figure 1).

One of the most interesting features of MathCad is the creation of animated sequences based on graphs. In Figure 2 the possibility of creating such an animated graphic to the above topic is demonstrated.

The multimedia use allows you to make a vivid historical digression. For example, mini-fragments of documentaries and videos presentation contributes to the semantic content of the lecture. The use of hyperlinks allows you to access the source of information directly during the lecture.

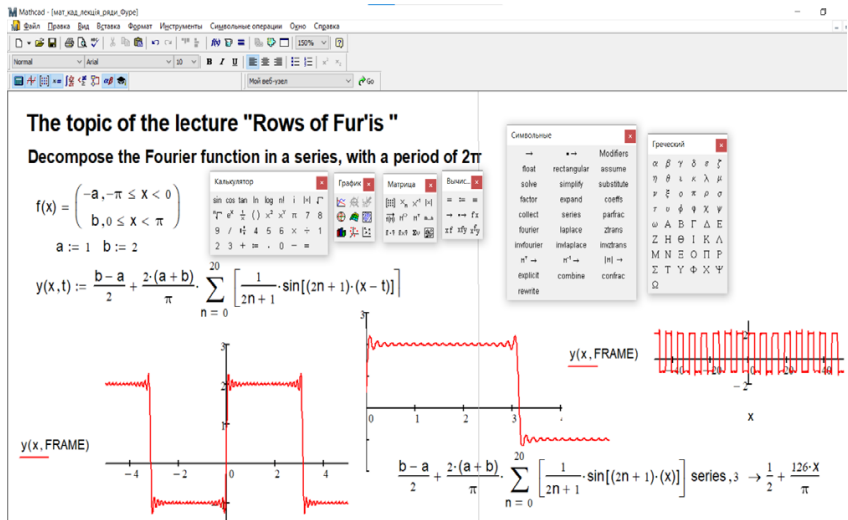


Figure 1. Data processing and visualization on the topic "Fourier series"

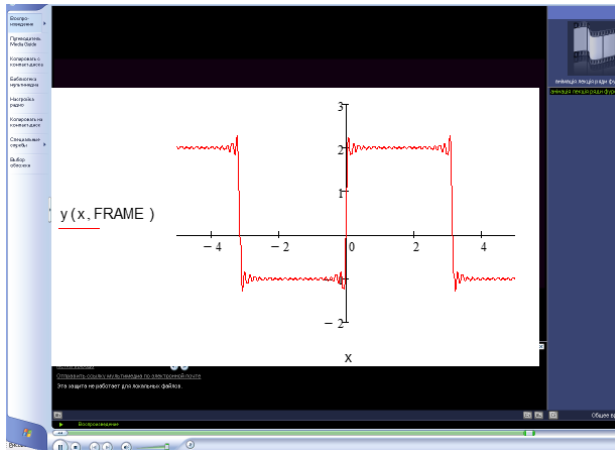


Figure 2. Creating an animated video

The lecture prepared in this way allows you to build educational material in a logical sequence, compact the material, reduce losses during the information perception related to the shortcomings of audio perception, make the most of all types of student memory: visual, motor, audio. Students can access the lecture materials at any convenient time due to the electronic data bank contained in the discipline card.

The multimedia tools use in practical classes allows you to intensify the learning process, deepen the study of educational material and improve its memorization.

Involving students in the coverage of results with the involvement of multimedia saves time to respond, gain skills in information processing, coding it in analytical form and in the form of graphics.

In addition, computer test programs allow you to create an individual version of the task instantly and process the results, increasing the time for error analysis.

Thus, we define the educational functions of multimedia:

Educational activities management;

Educational information in various forms presentation;

Training activities for the formation of various skills and abilities organization;

Educational activities control;
Communicative situation creation;
Educational process reference and information support.

Therefore, the using multimedia experience analysis in the training process allows us to identify the following benefits:

Flexibility. Ability to adjust the complex depending quickly on changes in training requirements.

Parallelism. The parallel with the traditional disciplines study. The multimedia use does not deny, but complements traditional teaching methods.

Versatility. Simultaneous access to educational information several sources (electronic libraries, data banks, knowledge bases).

Frugality. Educational areas effective use, technical means, concentrated and educational information unified presentation and multy access to it.

Manufacturability. The the latest advances use in information and telecommunications technologies in the educational space contributes to the promotion of the individual in the global post-industrial information society.

Formation of individual educational trends on the basis of learning mixed forms.

The development strategy of modern information technologies is characterized by the orientation from information to knowledge. Computer programs are knowledge carriers in the sense that they include not only information in one form or another, but also transforming information algorithms that ensure the didactic goals achievement. Methodological complexes that provide flexible individualized forms of blended learning are often used nowa-days. Profound analyses of the included information, as well as methodically and didactically sound strategy and learning algorithms allow you to enjoy the both full-time and distance learning benefits.

The optimal result is achieved due to a number of advantages of blended learning:

- focus on individual characteristics of the student;
- high-level thinking skills development according to Bloom's taxonomy;
- advantages realization of the teacher and the student partnership activity;

- decision-making using knowledge bases learning;
- personalization training support;
- productive gamification;
- mobile world of the student;
- broadband communication;
- academic integrity.

In blended learning, the personal educational environment is considered as “a set of components of the educational system obtained from the information and communication educational environment by adapting them to the goals, content and planned learning outcomes, needs and abilities of students” [8, p. 198].

Resources of blended learning contribute to the training formation individual style, maximizing the aptitudes, abilities, interests of the specialist in research activities. Under the described conditions, there are opportunities to create different conditions for learning: individual-oriented counseling, assistance in eliminating gaps in basic training, adjusting the movement depending on age, environment, subject position tendencies. Given the self-organization and self-regulation personal ways, it is possible to choose the pace, forms and methods of learning, both individual and group, both distance and classroom.

Under the described conditions, a rich active information environment is created, in which the professional socialization goal of the specialist is achieved.

Designing blended learning technology embodies a didactic system, the elements of which are the following components: target, content, methods and forms, implementation technology, testing and adjustment, analysis and forecasting. The system corresponds to the nonlinear objects structure that are subject to the system-forming factor – the target component (transition to the competency personality-oriented training model).

The target component design of and the structural elements selection is based on the study of the theoretical foundations of the problem and reasonable psychological and pedagogical conditions for the technology introduction.

The multilevel content component involves the invariant and variable components allocation and the structural and logical scheme of the course development.

After that the scientific and methodical complex of the discipline is formed, the development of forms and methods of educational and cognitive activity adequate to the semantic component is carried out, implementation technology is developed.

The didactic complex contains the discipline program, lecture notes, video lecture course, electronic manual, methodical instructions, manual of the basic course “Mathematics”, materials for use in the mode of electronic board Drawchat, presentations, information resources (test tasks, discipline card, electronic journal, repository in the Socrates system, means of control [9; 10; 11; 12].

The described technology of blended learning involves the use of electronic control system “Socrates”.

This methodological complex is both a self-study convenient tool and a multimedia educational materials modern resource for teachers. It is an element of the educational environment which includes traditional educational resources, electronic textbooks, the human factor.

Since the didactic complex is primarily focused on the possibility of its use in the blended learning system according to the individual program, it expresses the didactic open subsystem. Due to this, it can be supplemented with additional materials (specialized literature, materials for in-depth study, reference materials). For example, at the Agronomy and Forestry Department we used educational materials on mathematical statistics to process data obtained in field research, reference book “Correlation and regression analysis in Mathcad”, guidelines “Higher Mathematics: Differential Equations, Series” [13; 14; 15].

An effective resource is a set of video lectures. In this case, the inverted class principle is effective, according to which the new material assimilation by students takes place at home, and the classroom work time is allocated for consultations and problem solving.

Inverted classroom – the learning principle, according to which the new material main assimilation by students takes place at home, and classroom time is allocated to tasks, exercises, laboratory and practical research, individual teacher consultations, and answers to questions from students. The principle was proposed in 2007 to students by two science teachers, Jonathan Bergman and Aaron Sams. They started creating short video podcasts with lecture materials that students had to watch at home.

Thus, the teaching aids new generation, especially video lectures, has significantly changed the vocational education functions perception. Video content becomes not additional, but the leading means at the educational process stages, freeing the teacher from mechanical reproductive work, giving him new opportunities for for content creative search, methods, techniques, means of working with students. In the conditions of using this type of educational content, the teacher has not only the functions to teach students to use a specific source of information, but also such as dialogue, the education of getting information, advice and control during various creative tasks without which it is impossible to provide the comprehensive personality development.

However, the video course remains one of the main tools of the educational process, which is not opposed to the investor, but provides him and his students with comprehensive assistance.

Whiteboard is an effective tool for the personality-oriented distance learning implementation.

This resource allows participants in the learning process to communicate virtually, moving to active forms (dialogue, cooperation, creative learning activities), reproducing images in a joint document (board) that all participants see. The teacher can work simultaneously with a group or with individual students on different boards, making learning both individual and differentiated.

Therefore, in our work we have preferred the free web service Drawchat [16].

We use its opportunities for audio and video communication to discuss seminars, consultations, joint projects in real time. The resource allows the participant to prepare tasks in advance, save and then present in real time for discussion and addition. The service helps to integrate the content of educational information through: modeling in subject, graphic and symbolic forms.

In addition, our choice is due to a number of other organizational benefits: free; intuitive interface; registration is not required for work; to organize joint work, it is enough to send a URL to the participants; availability of webcam and microphone; ability to download PDF files and images; the ability to share on social networks and send links by QR-code.

In addition, we use MeisterTask mind maps and the Zoom platform.

For short-term simple communication in cases of situational response, in the described model we use Viber messenger.

In addition, it is effective in the classroom for commenting on lecture material, which strengthens the teacher's connection with students.

In the mixed learning context of mathematical disciplines, a wide range of opportunities arises when using a computer algebra system from the class of computer-aided design systems Mathcad.

The use of Mathcad in future agrarians mathematical training is carried out at three levels: the teacher's use of mathematical system Mathcad on classical examples demonstration, laboratory work implementation in which students learn to use computing and visual capabilities of the system independently, independent task setting based on problem approach. As a result, students, using the Mathcad system, solve professional problems that involve the knowledge integration from several disciplines and the mathematical apparatus use [17, p. 199].

The methodological complex important component is the electronic manual. Along with the widespread introduction into the educational process, there are now ambiguous interpretations of the term electronic manual. Consider some of them.

Electronic manual – a computer, pedagogical software designed primarily to present new information, which complements the printed publications, which is used for individual and individualized learning and allows for control and corrective diagnosis of the student.

An electronic textbook is an educational electronic publication with a systematic presentation of the discipline (its section, part), in which textual, audio, graphic and other information is evenly and interconnected with the help of appropriate software, which ensures the didactic cycle of learning continuity and completeness serves for group or individual training, corresponds to the curriculum and is intended for use in the educational process.

We are inclined to believe that the e-textbook is a new type of textbook that contains a complete and systematic presentation of the content of the course or part of it. The materials of the manual are arranged so that at any time you can go back or go to study additional material. The course can be studied in a computer class or at home. For each course there is an opportunity to assess their knowledge. The manual is convenient for

distance learning. An electronic textbook, as a new type of learning tool, can be an open or partially open system, ie a system that allows you to make changes to the content and structure of the manual.

The development of an electronic textbook is one of the leading areas of activity of higher education institutions mastering distance learning is the main in distance education means of learning, containing elements of any didactic system.

The main characteristics of the electronic manual are:

- multilevel and, as a result, taking into account the students individual characteristics;
- brightness, color, imagery, clarity, educational information accessibility in comparison with traditional one;
- the ability to demonstrate objects, phenomena, experiments that are not available under normal conditions;
- interdisciplinary links consolidation, rapid review of the previous material;
- easier navigation and search for material;
- a large number of training exercises. Knowledge acquisition rapid diagnosis;
- instant introduction of necessary changes and adjustments to the electronic manual, which saves costs that would be required to republish huge circulations of paper books;
- accessibility, thanks to the electronic manuals online presentation.

Thus, in contrast to the traditional electronic textbook should not only broadcast scientific facts, but above all, teach readers ways to master knowledge, their replenishment and improvement, contain the basic methodological principles of the discipline. The electronic textbook should be an intellectual self-teacher, to provide not only informational, but also motivational and cognitive functions of learning. Students must find guidelines for self-realization of their own learning opportunities and independent learning.

At the same time, the progress achieved in recent years in the introduction of electronic textbooks in the educational process requires a deep scientific substantiation of didactic and methodological bases of their use, defining the conceptual foundations of electronic textbooks, comprehensive solutions to the theory, methodology and technology.

Experience shows that electronic textbooks can be successfully used in the disciplines teaching of related to completely different knowledge fields. We propose to consider the creation and use features, developed by the authors, electronic textbooks in the disciplines of “Higher Mathematics” and “Political Science”, adapted for students of agricultural institutions of higher education.

The main stages of the electronic manual development:

1. Choice of sources.
2. Development of concepts lists content.
3. Transformation of texts in the module by sections.
4. Hypertext implementation in electronic form.
5. Development of computer support.
6. Selection of material for multimedia embodiment.
7. Visualization material preparation.
8. Material visualization.

The creation of the manual “Higher Mathematics” was carried out for the needs of didactic specialists training on the basis of modular and integrated technologies with their information support. The authors conducted a thorough comparative analysis of curricula in “Higher Mathematics” and professionally-oriented disciplines, which allowed them to find optimal ways to transform theoretical positions into practice. Practically every theoretical calculation that has an abstract character is accompanied by its practical interpretation.

The high scientific level introduction substantiates the need to study the discipline, its relevance and feasibility in the training system. The authors adhere to the correspondence of special concepts introduced into the course of mathematics, their scientific content and internal logic of mathematics. The sufficiency of the mathematical base for the consideration of professionally-oriented models is traced.

The manual is a means of forming a holistic picture of professional activity, through the use of an integrative approach to its content formation. Its peculiarity was to take into account the professionally-oriented disciplines requirements. This is due to the large interdisciplinary function of mathematics, including in agriculture. A number of its concepts have mechanical, biological, chemical, ecological, economic meaning (derivative, integral). At the same time, the manual contains many professional terms

and concepts formulated in the language of mathematics. The content of the manual is based on the fundamental principle of building mathematical models of the studied phenomena. One of his tasks is to demonstrate that the use of mathematical modeling allows a deeper, more comprehensive, more complete study of related disciplines. The manual will allow the future specialist to compare the real situations that surround him in the world with the mathematical apparatus that is offered to him in higher education.

The manual contains separate sections, which are devoted to the basics of work in the latest version of the mathematical software package Mathcad-14, tasks for independent work, modular control tasks, test tasks.

The manual is a rational, effective didactic tool in forming a holistic knowledge system and future professional skills, will promote the formation of generalized and systematized professional knowledge and skills, creative skills, increases learning motivation, is an effective tool in eliminating shortcomings in the educational process, inconsistencies in the content and chronology academic disciplines study.

The textbook “Higher Mathematics” presents theoretical material and examples of solving typical problems in the section of differential calculus of a function of one variable of the course. Each topic is accompanied by data visualization and task examples in the latest version of the mathematical software package Mathcad-14.

Thus, the created manual in the logic of variable and personality-oriented education provides a solution to the problems associated with the new requirements for the education system that is the training process qualitative improvement basis.

Studying the course “Political Science” involves mastering a certain knowledge level about the political life essence, political relations and processes. The result is the students ability to navigate in the main political schools, concepts, international political life processes, geopolitical situation, place, role and status of Ukraine in the modern political world.

The manual purpose is to give students an idea of political life, political society sphere, its development patterns, as well as the knowledge system about modern political institutions, rights and freedoms in a democratic society, types and forms of political processes, content and ways of political culture forming.

The aim of the manual is to promote the formation of students’ necessary skills and abilities to apply the modern political thinking principles to

analyze and find answers to political questions and problems facing society, and in the future to take an active part in solving modern problems of Ukrainian society progress.

The textbook “Political Science” outlines the main problems of political science at the level of their modern vision and existing political science concepts.

The publication is designed in the form of separate lectures containing theoretical material, control questions, a list of recommended reading. Each topic is accompanied by tasks for independent preparation: problem questions and tasks, topics of abstracts, test questions.

The content of the manual is based on a competency-based approach to training and is a means of active teaching methods

Summing up, we note that the electronic manual is an integral part of full-time training:

- allows you to bring to lectures and practical classes part of the material that requires visualization;
- allows independent processing of that part of the material that was outside the classroom;
- allows you to optimize the ratio of the number and content of examples and tasks that are considered in the audience and assigned to self-study;
- allows you to individualize work with students, especially the part related to homework and tests.

According to the analysis, most students in the early stages of study are well aware of the need to use information technology in their professional activities. The cognition effect is enhanced if the educational tasks are related to the practical activities of the future specialist or are of interest in his current educational activities.

Introduction of distance learning.

Distance learning is one of the promising learning technologies that plays a significant role in the modernization of education.

It is undeniable that the “generation of Google” has been involved in innovative technologies since childhood and has modern approaches to information, it has no experience of pre-network experience. Today, the Internet is the most popular source of information among others. Thus, according to a report by the non-profit organization Online Computer Library Center, about 83% of students begin to collect any information

from the search engine and only 2% pay attention to library sites or real book collections [18].

But young people are not only the future, but also the present. Thus, information technology is an integral part of its formation. This is due to the nature of the cognitive process as a reflection of human objective reality. Therefore, it is necessary to give preference to education that would provide for the worldview peculiarities of modern youth. And the task of educators at the present stage, moving to the “territory of youth”, to make the learning process thoughtful, rational, comfortable, in which the student will feel their success and intellectual ability.

Today, information technology penetrates to the depths of any professional activity, influences the style, content and methods of work, enriches it, expanding the scope. Therefore, the widespread use of new information technologies in all spheres of public life requires from the future specialist knowledge sufficient for the confident use of such technologies in their own professional activities.

But, despite the fact that a significant number of educational institutions have access to computer networks, established stereotypes often inhibit innovative development, make it impossible to perceive and implement new ideas, new techniques and technologies. One of the reasons is that such training requires universal training of teachers who have modern pedagogical and information technologies, psychologically ready to work with students in a new educational and network environment.

Therefore, the requirements of the information society for the preparation of graduates of higher education institutions for the use of modern information and communication technologies are in conflict with the lack of the necessary educational and methodological support for such training; the level of scientific achievements of computer science, psychological and pedagogical sciences contradicts their reflection in the content, methods, forms and means of teaching.

One of the areas of reform and development of modern higher education, which requires full information support, is distance learning, which is becoming increasingly popular in the world. This is one of the promising learning technologies that plays a significant role in the modernization of education. Scientists argue that the personal and telecommunication nature of learning – the main features of distance

learning (V.Y. Bykov, V.M. Kukharenko, V.A. Trainev, E.S. Polat, P.V. Stefanenko, A.V. Khutorskaya etc.). We adhere to the study of the definition of distance learning V.Y. Bykov as ensuring the provision of educational services at a distance with the help of new computer and communication technologies, universal, synthetic, integrated, humanistic form of education. Thus, the main purpose of distance learning is to provide equal educational opportunities to the population in all parts of the country through information and telecommunications.

Forms of organizing distance learning activities are diverse – from Internet conferences and webcasts of lectures to educational web forums and the like.

Today, the world's leading universities have successfully conquered the distance education market. D. Fischer pointed out several reasons for the rapid development of distance education: "1) The modern market forces us to engage in distance education, otherwise we lose – our students will go to other educational institutions. 2) The future of higher education – In the distance sector, so we need to be there in order not to fall out of the struggle. 3) We must use the intellectual property of university education wisely, as it is done in the case of patents. 4) We do it simply because we have the resources and new niches in the educational market" [19].

Many scholars define a training course as a distance course in which 80% of the training material is based on the use of on-line technologies. Currently, the world disciplines are taught in the following formats: traditional teaching, courses with network support, hybrid or mixed course, on-line course. Distance learning can take place within all types of didactic system.

Researchers argue that the personal and telecommunications nature of learning are the main features of distance learning. We adhere to the study of the distance learning definition as the provision of educational services at a distance with the help of new computer and communication technologies, universal, synthetic, integrated, humanistic form of learning.

Forms of organizing distance learning activities are diverse – from online conferences and webcasts of lectures to educational web forums and the like.

Note that the subject taught remotely has certain didactic features. This is a clear structure, which includes a methodological section, a substantive section, diagnostic and correctional blocks.

We have defined the principles of content selection in the distance learning context of the focus of the content on future professional activities; ensuring the educational tasks differentiation; the choice of ways to manage the educational and cognitive activities of students; interactivity; ensuring clarity and adequacy of educational material; feedback; structure, dynamism and variety access to educational material.

The practical implementation of these courses around the world has shown that the distance learning technologies usage requires a clear system of the discipline didactic development, structuring the curriculum, developing an interaction scheme between teacher and student, information and software support.

The subject, which is taught remotely, has certain didactic features. This is a clear structure, which includes a methodological section, a substantive section, diagnostic and correctional blocks.

The methodical block aims to give detailed instructions, teach students to work competently with a large flow of information obtained at a distance (collect facts, analyze, hypothesize, make generalizations, find alternative solutions, establish patterns, draw conclusions).

The content block is the didactic equivalent of the relevant science. We have defined the principles of content selection in the context of distance learning: the focus of the content on future professional activities; ensuring the differentiation of educational tasks; the choice of ways to manage the educational and cognitive activities of students; interactivity; ensuring clarity and adequacy of educational material; feedback; modularity and structure, dynamism and diversity of access to educational material.

But the peculiarity of distance education is, first of all, forms of learning. Recently, the material presentation in the form of video lectures (webinars) has become popular. Webinar (from webinar – web-based seminar), translated as “seminar organized on the basis of web technologies”. Webinar – interactive technology. Webinar students not only listen to and “see” the teacher and demonstration materials, but can also ask him questions orally or in writing directly in the chat during the lesson. The speaker also “sees” all participants and can ask questions to all at once or to individuals. Webinars (depending on the provider) may have an anonymity feature. The remote form of presentation of the material has a number of special requirements. The practice of conducting such classes by us allowed us to develop the main ones:

Presentation materials should be informative, but not oversaturated with information. The font should not be too small, the colors should be high contrast.

Excessive staff changes are not recommended.

If students need to explain a complex formula or material to understand what is needed to be focused and be as attentive as possible, it makes no sense to include multimedia elements in this slide of the presentation.

The attention of listeners when presenting information in this format is easily distracted. Therefore, it is necessary to change the tone of the lecture, ask questions, change the information type.

The lecturer should actively comment on the presentation material.

In turn, the multimedia technologies competent use in the educational process, undoubtedly leads to a faster understanding and of new information assimilation.

In figure 3 an element of the relevant working document is presented. You need to take into account the fact that on the computer screen this picture is moving, the viewer can instantly change the parameters, scale and view angle. In traditional teaching, this is difficult to do without technical equipment.

Outside of the lecture, as a rule, the main content of the discipline is transmitted through an electronic manual [5; 6], which contains theoretical information equipped with hyperlinks and vivid multimedia illustrations (graphics, audio and video), interactive learning models, practical tasks bank, computer laboratory work, on-line laboratory, training and testing unit, integrated with the tasks database, focused not only on working on a local computer but also on local networks and the Internet, etc.

In addition, distance learning provides the opportunity to solve problems, take tests, communicate with a virtual teacher, get advice on the Internet or, as mentioned above, communicate directly with the virtual audience on-line chatting during the webinar.

Diagnostic and correctional unit is characterized by the mechanisms presence for diagnosing the students' knowledge quality, followed by their correction. In this component, the control over the students educational activities (in terms of distance learning) is complemented by the input and output parameters study. This block provides for strict and regular reporting, which makes it impossible to help others. The criteria of this component are self-assessment of one's own abilities, ability to self-improvement taking

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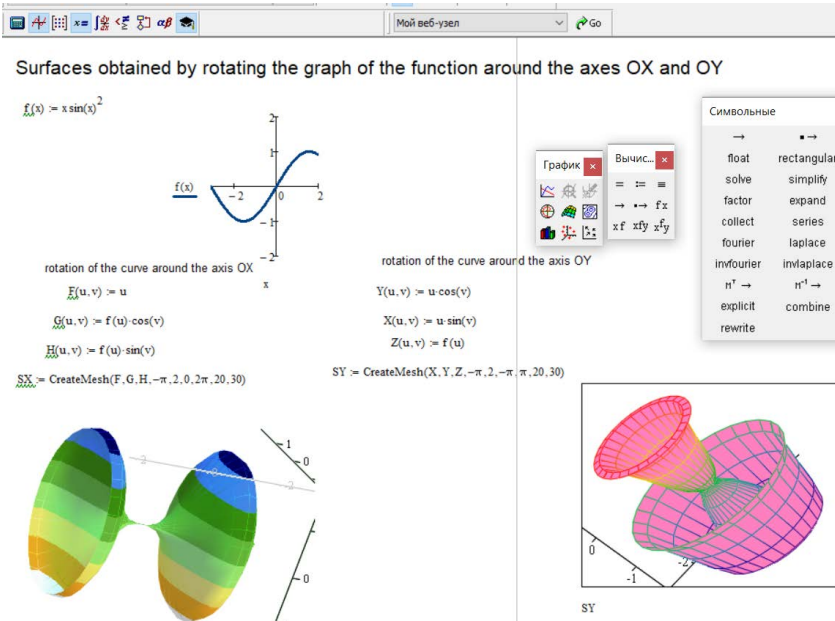


Figure 3. Visualizations on the topic: “Surfaces of rotation”

into account individual characteristics. The Ukrainian students mentality and the normative unresolved issues of organization and knowledge assessment do not yet allow to distance this unit completely.

Therefore, the teacher can use distance learning courses or their components for:

- demonstrations and illustrations of texts, formulas, unobserved phenomena;
- solving experimental problems using animation experiments;
- conducting practical and laboratory work;
- control over the level of students’ knowledge according to the methods of differentiated learning;
- current control of knowledge using modern technologies distance learning;
- computer experiment self-creation.

The main tasks of forming the qualification of teachers for distance learning include: computer technologies adaptation for distance learning; optimal theoretical material selection; the most effective forms selection, teaching methods and techniques that create the necessary conditions for information independent processing; isolation and introduction into the educational process of pedagogical conditions that contribute to the knowledge acquisition quality.

Summarizing the above, we conclude that the pedagogically justified introduction of distance learning has a number of advantages:

- time and money significant savings. Process learning will not be hindered by time factors and geographical location;

- interactivity high degree. Students are actively involved in the learning process, can ask questions, clarifying unclear points;

- methodical materials are constantly available, webinars are recorded. This allows students to develop an individual learning regime.

- strengthening the clarity and learning intensity;

- the content of the discipline instant updating;

- supplementing the content with unobserved processes and phenomena that require figurative perception;

- along with demonstration and laboratory devices and tools, use of high-quality demonstration models created on the basis of information and communication technologies of training;

- exemption from routine calculations and repetitive algorithms;

- accessibility of training for people with physical disabilities that make face-to-face learning impossible.

However, today there are a number of disadvantages:

- psychological unpreparedness and insufficient computer literacy of some students and teachers;

- conscious motivation lack, self-discipline, the self-education need in some students;

- weakening or lack of psycho-emotional contact of the teacher with the audience;

- the quality technical equipment need;

- constant control lack.

Thus, the distance forms introduction in the educational process, first of all, involves the interaction and integrity of three components: organizational forms, didactic process and teacher qualifications.

Given the above, distance learning can be said as a pedagogical technology that is based on the independent learning principle and aims at the individual creative development. A prerequisite for its effective use is high-quality information content that provides support for the learning process. Today, the educational environment of the education system of Ukraine is designed to fill the created channels with such information and provide qualitatively new conditions for the entire education system.

Focus on the synergetic paradigm of education, which is closely related to the integration and systematization processes of the educational content, its openness.

The synergetic approach makes it possible to consider any self-organizing process in the transition from chaos to order due to the internal factors of self-organization and self-government. Synergetics scientifically proves that in complex systems of any nature and any level of order, which is in an unbalanced state, weak control signals at the “input” can involuntarily increase at the “output”, leading to radical changes in the system organization.

In synergetics, mainly open systems are considered. Their essential feature is that they can be managed by changing external factors. When these essential factors are kept constant, they can be taken into account in the equations by setting the appropriate parameters constant. For example, the rate of growth of students’ knowledge is regulated externally on the basis of the relevant factors influence (content, forms, teaching methods, etc.). The evolution of synergetic systems is due to reasons that cannot be predicted with absolute accuracy. They can be partially determined by taking into account fluctuations (random deviations of the values of certain quantities from their average values). In didactic systems, fluctuations are especially important because they reflect a variety of subjective factors that “hinder” the formation of clear didactic theories and principles: individual characteristics of students, specific learning conditions, social conditions and more.

On this basis, there are three essential features of synergetic processes: correlation, self-organization, opposites oscillation (chaos – order, integration – differentiation, etc.).

4. Conclusions

Thus, the combination of integration ideas, information technologies introduction, distance education, synergy allows to consider the issue of training at a qualitatively new level. The most important, in our opinion, in the conditions we are considering, is the approach to training future professionals as an open system.

The priority steps in these pedagogical conditions implementation include: optimal theoretical material selection; the most effective forms selection, learning methods and techniques that create the necessary conditions for independent information processing, multimedia tools adaptation and computer technologies for distance learning.

Peculiarities of integrative training of specialists in an agricultural institution of higher education, due to the specifics of objects and methods of solving specific problems in the agricultural sector. These pedagogical conditions are an effective means of eliminating existing contradictions in the training farmers system, in particular, their compliance is a necessary condition for training that meets modern needs of practice.

References:

1. Talanova Zh. (2014). Aktualni problemy zabezpechennya yakosti osvity: pidsumky mynulogo roku ta plany na 2014 rik [Actual problems of quality assurance in education: last year results and plans for 2014]. *Vyshha shkola – High school*, no. 3–4, pp. 107–108.
2. Debych. M. (2014). Zavdannya vyshhoyi osvity u zabezpechenni vymog rynku praci [The task of higher education in meeting the labor market requirements]. *Vyshha shkola – High school*, no. 2, pp. 50–57.
3. Terlecзка Yu. (2014) Efektyvnist faxovoyi diyalnosti vykladachiv vyshhyx navchalnyx zakladiv: pedagogichno-psyhologichnyj aspekt [The effectiveness of teachers' professional activities of higher educational institutions: pedagogical and psychological aspect]. *Vyshha shkola – High school*, no. 1, pp. 81–88.
4. Krokhin A. L. (2014). O kognitivnoy teorii mul'timediynogo obucheniya R. Mayera i vzaimosvyazi verbal'noy i vizual'noy komponent leksionnoy prezentatsii matematicheskikh distsiplin [About the cognitive theory of multimedia learning by R. Mayer and implementation verbal and pictorial layout]. *urfu.ru*. Retrieved from: <https://elar.urfu.ru/bitstream/10995/24629/1/notv-2014-105.pdf> (accessed 10 January 2022).
5. Levchuk O. V. (2020). Vyshha matematyka [Higher mathematics]. Elektronnyj navchalnyj posibnyk. Vinnycya. *vsau.org*. Retrieved from: http://socrates.vsau.org/b04213/elbook/view_index.php (accessed 10 January 2022).
6. Levchuk K. I. (2020). Politologiya [Politicalogy]. Elektronnyj navchalnyj posibnyk. Vinnycya.

7. Bulgakova I. V. (2012). Aktivizatsiya protsessa obucheniya s pomoshch'yu elektronnoho uchebnogo kursa dlya interaktivnogo kompleksa [The learning process activation with the help of an e-learning course for an interactive complex. *Gorizonty obrazovaniya – Horizons of education*, vol. 4(36), no. 3, pp. 80–84.
8. Slepukhin A. V. (2014). Ispol'zovanie personal'noy obrazovatel'noy sredy v protsesse individualizatsii smeshannogo obucheniya studentov [The personal educational environment implementation in the process of individualization of blended learning]. *Pedagogicheskoe obrazovanie v Rossii – Pedagogical education in Russia*, no. 11, pp. 195–205.
9. Levchuk O. V. (2019). Matematychnye modelyuvannya na bazi Mathcad yak zasib formuvannya profesijnoyi kompetentnosti majbutnix ekonomistiv. [Mathematical modeling based on Mathcad as a means of the professional competence forming of future economists]. *Ekonomika. Finansy. Menedzhment: aktualni pytannya nauky i praktyky – Economics, finance, management: topical issues of science and practice activity*, no. 5, pp. 73–78.
10. Levchuk O. V. (2018). *Vyshha matematyka* [Higher mathematics]. Vinnytsya: VNAU. (in Ukrainian)
11. Levchuk O. V., Dyachynska O. M. (2019). *Vyshha matematyka (faxove spryamuvannya)* [Higher mathematics (professional direction)]. Vinnytsya: VNAU. (in Ukrainian)
12. Elektronna systema upravlinnya «Sokrat» VNAU [Electronic control system «Socrates» VNAU]. *vsau.org*. Retrieved from: <http://socrates.vsau.org/index.php/ua/pro-system> (accessed 10 January 2022).
13. Levchuk O. V., Dzis V. G., Novyczka L. I. (2016). Korelyacijno-regresijnj analiz v Mathcad [Correlation-regression analysis in Mathcad]. Vinnytsya: VNAU. (in Ukrainian)
14. Levchuk O. V., Dzis V. G., Novyczka L. I. (2016). *Vyshha matematyka: dyferencialni rivnyannya, ryady* [Higher mathematics: differential equations, series]. Vinnytsya: VNAU. (in Ukrainian)
15. Levchuk O. V., Dzis V. G., Dyachynska O. M. (2019). *Prykladna matematyka na osnovi* [Mathcad. Applied mathematics based on Mathcad]. Vinnytsya: VNAU. (in Ukrainian)
16. Draw.Chat – Virtual Classroom. Retrieved from: <https://draw.chat/> (accessed 10 January 2022).
17. Levchuk O. V. (2016). *Texnologiya matematychnoyi pidgotovky majbutnix agrariyiv na osnovi zastosuvannya Mathcad* [The mathematical training technology of future agrarians based on Mathcad implementation]. *Suchasni informacijni tehnologiyi ta innovacijni metodyky navchannya v pidgotovci faxivciv: meto-dologiya, teoriya, dosvid, problemy – Modern information technologies and innovative teaching methods in training: methodology, theory, experience, problems*, no. 47, pp. 197–201.
18. Vzgljad. Delovaya gazeta (2008). Razvenchan mif o «pokolenii Google» [The myth of «Google generation» revealed]. *vz.ru*. Retrieved from: <http://www.vz.ru/society/2008/2/25/147116.print.html> (accessed 10 January 2022).
19. Douglas Fisher. *The Distance Learning Playbook*. Retrieved from: <https://www.principalcenter.com/douglas-fisher-the-distance-learning-playbook> (accessed 10 January 2022).