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CHAPTER 4. DIGITAL EDUCATIONAL TECHNOLOGIES IN PROFESSIONAL TRAINING OF HIGHER EDUCATION STUDENTS IN THE ENERGY FIELD

4.1. Application of Educational Software in the Educational Process of Training Higher Education Applicants in the Energy Field

The modern higher education system in Ukraine is undergoing active transformation in accordance with the requirements of the digital economy, technological development and the needs of the labor market. One of the key factors in improving the quality of professional training of future specialists is the introduction of information and communication technologies (ICT), in particular educational software (SW).

Educational software is a set of digital resources and applications that ensure the effective acquisition of theoretical knowledge, the development of professional skills, the formation of key and special competencies, as well as the creation of a personalized educational environment. In the context of vocational education, SW acts as a tool for modernizing the content of education, intensification of the didactic process, and support for interactive and distance learning.

In higher education institutions (HEIs), educational software plays the role not only of a tool for supporting the educational process, but also of a means of professional development of the individual. Its effective use contributes to the formation of digital competencies, increased motivation for learning, the development of critical thinking and the ability to make decisions in digital production.

Software used in higher education institutions can be classified according to various criteria: functional purpose, form of interaction with the user, industry focus. Table 4.1.1 presents the classification of software by didactic functions.

Table 4.1.1

Classification of software by didactic functions

Software type	Didactic function	Example of use
Exercise machines	Skills development	Welding simulators, machine tool work
Educational systems	Learning the theory	Moodle, Google Classroom
Simulation programs	Process visualization	Tinkercad, Autodesk Fusion 360
Test programs	Knowledge control	MyTest, Classtime
Information and reference	Self-study	Electronic libraries, video tutorials

Educational software is a key factor in the formation of professional competencies, as it allows you to create situations close to real production. For example, with the help of virtual simulators, a student can practice welding skills or work on a CNC machine without risking damage to the equipment.

Today, the following digital resources are actively implemented in HEIs:

– Moodle – as the main platform for managing educational content, assessment, and communication;

– SimSpray, WeldingSim – for virtual modeling of welding processes;

– Autodesk Fusion 360 – for design training and 3D modeling;
– Labster, PhET – for visualization of physical and chemical processes;
– CodeCombat, Scratch – in the training of IT specialists.

Each type of software has specific applications, depending on the industry, direction of professional training, and didactic goal, which can be seen in Table 4.1.2.

Table 4.1.2

Use of software in training in different areas

Direction of training	Software	Educational outcome
Technical modeling	Fusion 360, AutoCAD	Design of parts, 3D visualization
Welding technologies	SimSpray, WeldingSim	Formation of practical skills
Electrical installation work	Multisim, Proteus	Assembly and testing of electrical circuits
Cooking	KitchenPal, Yummly	Recipe planning, process control
IT specialties	Scratch, CodeCombat	Logic development, programming

In turn, the development of a digital educational environment in higher education requires not only the availability of software, but also a clearly thought-out methodology for its implementation in the educational process. Methodological aspects of using software should take into account the specifics of professional training, the level of digital competencies of teachers and applicants, as well as requirements for the quality of educational content.

Integration of educational software into the professional training of applicants for higher education in the energy profile of the specialty A5 Vocational education requires a well-founded methodological approach that takes into account the specifics of the content of education, the level of ICT competencies of participants in the educational process, as well as the material and technical support of the institution. Among the main methodological principles, the following should be highlighted:

– differentiated approach – adaptation of software to the level of training of applicants, their educational needs and learning styles;

– integrativeness – combination of software with traditional forms of training, inclusion in the system of practical training;

– project activity – use of software for implementation of projects aimed at solving practical tasks;

– interactivity – active involvement of applicants through digital simulators, modeling and virtual laboratories.

– formative assessment – use of software for continuous monitoring of success and feedback.

It is also important to ensure training of teachers in the effective use of software, in particular through advanced training courses, internal trainings, exchange of experience between teachers.

Integration of software into professional training should be based on the following didactic principles:

– principle of clarity – software should provide visualization of abstract and complex technical processes (for example, 3D modeling in Tinkercad or Fusion 360);

– principle of interactivity – constant interaction of the applicant with the educational environment is necessary;

– principle of adaptability – software should take into account the individual characteristics of applicants;

– principle of professional orientation – content should correspond to the content of professional standards and programs.

The application of these principles contributes to the formation of sustainable professional knowledge and skills that meet the modern requirements of the labor market [1].

The software integration methodology involves the sequential passage of the stages presented in Table 4.1.3.

Table 4.1.3

Stages of software implementation in vocational training

Stage	Stage content
Diagnostic	Determining students' needs and their level of ICT competence
Design	Selecting appropriate software and developing scenarios for its use
Organizational and technological	Setting up the software environment, training teachers
Educational and practical	Implementation of training sessions using software
Control and analytical	Evaluating the effectiveness of software application

The use of a phased approach allows not only to ensure the integrity and systematic implementation, but also to adjust the process based on the results of diagnostics and monitoring [2].

In practice, different types of software are used in higher education institutions, depending on the professional direction:

– profession "Manual welding electric welder" – use of the "WeldingSim" simulator to practice welding techniques;

– profession "CNC machine operator" – use of the Siemens SINUMERIK Operate environment for modeling CNC programs;

– profession "Cook" – use of the interactive educational complex "KitchenPro" for training culinary skills;

– profession "Electrician": use of the "AutoCAD Electrical" program for designing electrical network diagrams.

This approach allows you to integrate practical activities with theoretical training, which contributes to better assimilation of the material [3].

For the successful implementation of software in vocational training, it is advisable to adhere to the following recommendations:

– conduct a preliminary selection of programs taking into account the professional orientation;
– provide for the integration of software into curricula;
– organize training for teachers in the use of modern digital tools;
– create author's electronic resources to support classes;
– provide feedback to applicants through LMS platforms (Moodle, Google Classroom).

The use of software should be accompanied by methodological support, which involves the creation of instructions, video lessons, and accompanying methodological materials [4].

The use of software makes it possible to integrate elements of STEM education, develop project thinking and preparation for work in a digital production environment.

Thus, the use of educational software in higher education institutions is an important component of the renewal of higher education, which opens up new opportunities for both applicants for higher education in the energy profile of the specialty A5 Vocational Education, and for the teaching staff of higher education institutions. Educational software allows you to create a dynamic, interactive, adaptive educational environment that meets the modern challenges of the labor market and the digital transformation of the economy.

4.2. Virtual Laboratory Practicum as a Form of Organization of Training in Energy Cycle Disciplines

In the professional training of higher education applicants in the energy profile of the specialty A5 Vocational Education, laboratory classes traditionally serve as an important form of practical assimilation of knowledge obtained during the study of energy cycle disciplines. They contribute to the development of technical thinking, skills to perform measurements, analyze the processes of generation, transmission and consumption of energy. However, traditional laboratories require significant material costs for maintenance, equipment renewal, and safety.

According to the state standards of higher education of Ukraine, important learning outcomes are:

– the ability to carry out professional activities based on a deep understanding of the principles of operation of energy equipment;
– the ability to practically apply knowledge in situations close to production;
– the development of skills in modeling and analyzing energy processes.

In this context, virtual laboratories are a powerful tool for implementing these requirements.

A virtual laboratory practicum (VLP) is a digital simulation platform that allows students to conduct experimental activities in an online environment using special software.

Such a practicum may include:
– 3D models of equipment;
– virtual control panels;
– built-in instructions and prompts;
– a function for collecting and analyzing experimental results.

Features of VLP:
– multiple execution of experiments;
– the ability to learn at any time and in any place;
– integration with LMS systems (e.g., Moodle);
– saving resources and increasing security.

Table 4.2.1.

Comparative characteristics of traditional and virtual laboratory practice

Parameter	Traditional LP	Virtual LP
Cost	High	Moderate/low
Security	Partially risky	Completely safe
Learning flexibility	Limited	High
Equipment availability	Limited	Unlimited (models)
Possibility of repeating the experiment	Limited	Unlimited

The following software solutions are used to create VLP:
– LabVIEW – a visual programming environment for modeling control systems;
– PSpice – modeling electrical circuits;
– TINA-TI – interactive simulation of analog circuits;
– MATLAB/Simulink – for modeling dynamic systems, in particular electrical power processes;
– OpenModelica – an open tool for modeling multi-physics systems.

For the effective implementation of a virtual laboratory workshop on energy cycle disciplines, we offer a structure consisting of the following main blocks:

1. Theoretical training block.

Purpose: to familiarize students with the basic concepts, laws and principles related to the topic of the laboratory lesson.

Instructions for implementation:
1. Read the training materials (text, video, presentations).
2. Take the built-in test for self-testing knowledge.
3. Check the answers using the automatic assessment system.

2. Experiment simulation block.

Purpose: to enable students to simulate a laboratory experiment in a virtual environment.

Instructions for implementation:
1. Run the simulation in a software environment (for example, MATLAB/Simulink or LabVIEW).
2. Set the initial parameters of the experiment.
3. Observe the process and results in real time.

4. Save the simulation results in the form of graphs or tables.

3. Analytical processing of results block.

Goal: to teach applicants to analyze the results obtained, compare them with theoretical expectations.

Instructions for implementation:

1. Load the saved data.
2. Build the necessary graphs and diagrams.
3. Analyze the impact of changing parameters on the result of the experiment.
4. Write down the conclusions based on the analysis results.

4. Final control block.

Goal: check the level of assimilation of the material.

Instructions for implementation:

1. Take the test based on the results of the completed laboratory task.
2. Download the report in PDF format, containing:

– a brief description of the purpose of the experiment;
– screenshots from the software environment;
– the results obtained;
– analysis and conclusions.

The organization of VLP involves the creation of a holistic pedagogical model that integrates software, didactic tools, methodological support and mechanisms for assessing learning outcomes. The basis for the formation of such a model are the principles of accessibility, interactivity, security, adaptability and effectiveness.

In the context of digitalization of higher education, the VLP model must meet the requirements of a practice-oriented approach, provide for the possibility of repeating experiments, modeling real situations, automated data collection and analysis. At the same time, it is important to ensure integration with energy cycle disciplines, such as: "Electrical Engineering and Electromechanics", "Fundamentals of Energy Conservation", "Heat Engineering", "Hydraulics".

Let's consider the main components of the VLP model.

The VLP model consists of four functional blocks:

– Pedagogical block – defines the goals, objectives, content of training, forms and methods of organizing laboratory classes.
– Instrumental block – includes software, virtual simulators, visualization systems, a database of electronic resources.
– Methodological block – contains instructional and technological cards, laboratory work scenarios, feedback tools.
– Evaluation block – provides diagnostics of the level of knowledge, skills, formation of competencies, adaptation of tasks to the level of the applicant.

Stages of model development:

1. Analysis of training programs. Topics that require laboratory support are highlighted. Example: studying the principles of transformer operation.
2. Determination of technical support. The MATLAB/Simulink platform is selected, which allows you to visualize dynamic processes of power systems.

3. Creation of laboratory work scenarios. For example, the experiment "Determination of transformer efficiency under variable load".

4. User interface development. Interactive control panels, digital indicators, dependency graphs are included.

5. Integration with LMS Moodle. Monitoring of task performance, assessment and analysis of student results are implemented.

Table 4.2.2.

Example of a laboratory work scenario in VLP

Job title	Expected results	Software modules
Transformer operation study	Efficiency determination, process visualization	Simulink, Scope, Math block
Reactive power analysis	Construction of phase diagrams, calculations Q	Simscape Electrical
Power system automation	Implementation of a PI controller in a control system	Control System Toolbox

The specified model allows to achieve the following didactic effects:

– increasing the interest of applicants due to interactivity;
– the possibility of independent work at a convenient time;
– training in error analysis and process optimization skills.

The use of VLP allows to implement the following methodological principles:

– clarity – due to visualization of experiments;
– accessibility – the possibility of multiple repetition;
– individualization of learning – adaptation of the complexity of tasks;
– connection of theory with practice – simulation of real production situations.

Thus, the developed VLP model is a flexible and effective tool that combines modern information technologies with the needs of professional training of applicants for higher education in the energy profile of the specialty A5 Vocational Education.

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ANNOTATION

CHAPTER 1. MODERN BASICS OF ECONOMICS, MANAGEMENT AND TOURISM

1.1. Olha Podra, Nataliia Petryshyn STRATEGIC PLANNING OF FOREIGN ECONOMIC ACTIVITY OF ENTERPRISES: ANALYSIS OF MODERN TECHNOLOGIES AND SELECTION PRACTICES

The theoretical foundations of strategic planning of foreign economic activity of enterprises in the context of dynamic changes and innovative challenges are researched. It has been determined that modern technologies of strategic planning in the context of foreign economic activity should be comprehensive, adaptive and innovation-oriented. A model for analysing the choice of technologies for strategic planning at an enterprise in the context of foreign economic activity has been proposed, factors that should be taken into account when analysing the choice of technologies have been identified. It justifies a necessity of consideration of economic, managerial, social and technical factors, which determine selection of appropriate types of technologies of strategic planning at an enterprise.

Keywords: strategy, planning, technology, tools, factor analysis, foreign economic activity, management.

1.2. Nataliia Petryshyn, Olha Podra, Andrew Todoshchuk ORGANISATIONAL AND MANAGERIAL ASPECTS OF IMPLEMENTING STRATEGIC CHANGES AT ENTERPRISES IN THE CONTEXT OF THE FOREIGN ECONOMIC ACTIVITY DEVELOPMENT

The key aspects of managing strategic changes at enterprises in the conditions of a dynamic external environment and the intensification of foreign economic activity are highlighted. The nature of strategic changes, their role in the formation of competitive advantages and the main types of transformations are considered. The elements of organizational support for the change process are analyzed, and the factors of resistance to personnel changes are identified. The feasibility of using a set of management measures to overcome resistance and ensure the successful implementation of strategic initiatives is substantiated. The results of the study can be used to improve approaches to change management in the conditions of global challenges.

Keywords: strategic changes, management, organizational support, resistance to change, human resources, adaptation.

1.3. Iryna Khoma IMPROVEMENT OF RISK MANAGEMENT APPROACHES IN THE SYSTEM OF MODERN SAFE FUNCTIONING OF THE ENTERPRISE

The problem is considered, which, in the conditions of modern foundations of economics and management, is one of the most important that arises in the activities of enterprises - risk management in the achievement system and ensuring its safe functioning, the solution of which will allow strategically important business entities to develop stably and maintain their financial performance in risky situations, in particular in the conditions of a full-scale war in Ukraine.

Keywords: risk, risk management, system of safe operation of the enterprise.

1.4. Olha Hirna CRM SYSTEMS AS TOOLS FOR DIGITIZING CUSTOMER SERVICE IN THE AUTOMOBILE MARKET

The specifics of implementing CRM systems in the activities of car dealerships and dealerships are studied. Modern development trends are analyzed and the advantages of digitalization in interacting with customers in an unstable market environment are highlighted. The emphasis is placed on the growth of demand for the use of developed domestic CRM system products. The results of a comparative assessment of three popular CRM systems (SalesDrive CRM, KeepinCRM, KeyCRM) using the multivariate average method are presented.

Keywords: customer service, digitalization, CRM system, car market, software products, multidimensional average.

CHAPTER 2. INNOVATIVE AND MODERN FOUNDATIONS OF PEDAGOGY AND PSYCHOLOGY

2.1. Hanna Apalat DEVELOPMENT PECULIARITIES OF FOREIGN LANGUAGE SPEAKING COMPETENCE OF PRE-SERVICE ENGLISH TEACHERS

Effective technologies and means of forming pre-service English teachers' language competence are identified. The modern approaches to teaching English language through reading and grammar are analysed. The peculiarities of teaching technologies for close reading, communicative grammar, spoken grammar, and blended technologies are investigated. Samples of practical tasks for the formation and development of English language competence are offered.

Keywords: pre-service English teachers, close reading, communicative grammar, interactive teaching, spoken grammar.

CHAPTER 3. IMPROVEMENT OF SCIENTIFIC APPROACHES TO THE DEVELOPMENT OF PHYSICO-MATHEMATICAL AND TECHNICAL DIRECTIONS

3.1. Olena Vorobyova, Katerina Fedorova, Olena Rozhko ANALYSIS OF THE DEFORMED COORDINATE METHOD USED IN OF WIND WAVE CAICULATIONS IN DEEP WATER AND SHALLOW WATER

Specifics of defining characteristics for finite amplitude waves with the help of deformed coordinates method for deep water and shallowness are shown. Comparison of shallow water wave profiles for proposed approximate theory, Stokes and cnoidal theories is introduced. The essence of the hydrodynamic theory of waves is the mathematical study of the wave motions of an ideal fluid with a free surface. This theory makes it possible to accurately assess the internal dynamic structure of wave motion, the connections between individual elements of waves.

Keywords: deep water, shallow water, non-linear wave theory, deformed coordinates method, wave profile.

CHAPTER 4. Serhii Onyshchenko DIGITAL EDUCATIONAL TECHNOLOGIES IN PROFESSIONAL TRAINING OF HIGHER EDUCATION STUDENTS IN THE ENERGY FIELD

The section of the monograph considers theoretical and practical aspects of using educational software in the higher education system. Special attention is paid to the integration of digital tools in the training of higher education applicants in the energy

profile of the specialty A5 Vocational Education. The functional capabilities of modern software for modeling, calculations and demonstrations of technical processes are analyzed. The advantages of using a virtual laboratory workshop in teaching energy cycle disciplines are determined. The role of simulation environments in the formation of practical competencies is considered.
The effectiveness of distance and blended learning formats using specialized programs is shown. Methodological approaches to implementing such resources in the educational process are substantiated. The experience of using digital tools in leading higher education institutions is summarized. Practical recommendations for teachers and methodologists are provided. The materials of the monograph section can be useful for developers of training courses, teachers, scientists and specialists in the field of energy.
Keywords: vocational education, software, virtual workshop, educational technologies, digital resources, energy profile, energy disciplines.

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