**Ministry of Education and Science of Ukraine**

***Odessa National Academy of Food Technologies***


**International Competition of Student Scientific Works**

# BLACK SEA SCIENCE 2021

## Information Technology, Automation and Robotics

**Proceedings**

Odessa, ONAFT 2021

**UDC 004.01/08**

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**Black Sea Science 2021**: Proceedings of the International Competition of Student Scientific Works. Information Technology, Automation and Robotics. / Odessa National Academy of Food Technologies; B.Yegorov, M. Mardar, S.Kotlyk (editors-in-chief.) [*et al.*]. – Odessa: ONAFT, 2021. – 526 p.

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# INFORMATION AND COMMUNICATION TECHNOLOGIES AS A MEANS OF ORGANIZING TRAINING OF FUTURE TECHNICAL SPECIALISTS

Authors: ***Dmytro Tsarenko, Oleksandra Greenberg***
Advisors: ***Volodymyr Umanets, Liudmyla Shevchenko***
Vinnytsia Mikhailo Kotsiubynskyi State Pedagogical University, (Ukraine)

***Abstract:*** *We have to determine the theoretical foundations of the use of ICT in the training of future technical professionals. information and communication technologies include a set of methods, tools for finding, storing, processing, presenting and transmitting any kind of information using personal computers and the Internet.*

*Learning with the help of ICT The effectiveness of the implementation of ICT tools in the training of future technical specialists, first of all, depends on the material and technical base of HEI, which should include the computer network of the university, local computer networks of faculties and departments, as well as appropriate software.*
*is one of the most promising means of professionalism of future qualified technical specialists, as it allows future technical specialists to obtain the necessary data, differentiate and separate educational material, comprehensively perceive new information, repeat and consolidate knowledge and achieve self-realization. results.*

*Computer tests to control and test the knowledge and skills of future technical specialists in the discipline of «Applied Programming» were developed using the program MyTestX.*

*The main benefits of computer testing are that:*

- *the teacher has the opportunity to objectively assess the applicant for higher education, as the control of knowledge is carried out by the program;*
- *every graduate has the opportunity to assess their own knowledge;*
- *the quality of preparation of higher education students for classes increases and their activity and organization during independent processing of material increases;*
- *saves teacher time;*
- *the level of openness of the testing process increases.*

***Keywords:*** *HEI, ICT, Technical profile, Information security, MyTest, Internet*

## I. INTRODUCTION

Nowadays, information and communication technologies (ICTs) have become a powerful force in the transformation of social life and innovative development, and the widespread use of computer technologies in education is gradually, but quite confidently, becoming an essential part of the educational process.

The future of higher technical education applicants will depend, first of all, on how well they will be able to use and use information technology in their future professional activities, how well they will be able to accomplish their tasks competently and with new approaches.

Of course, the use of the latest technologies in their work practices will affect their career prospects.

Qualitative training of future specialists in the technical profile in higher education institutions (HEIs) is possible provided ICT is introduced into the educational process. The use of ICT is the norm in the training of technical professionals.

Another important step in the training of future specialists in the technical profile is the control and testing of knowledge and skills, which allows to obtain a certain quantitative assessment of the obtained learning outcomes.

Knowledge control and assessment is an integral structural component of the educational process. Based on the logic of the learning process, it is, on the one hand, the final component of mastering the content block, and on the other, a kind of feedback in the system of educational activity of the individual.

Due to the work of teachers on the credit-modular system, there is a problem of current modular control of knowledge of higher education applicants and their assessment on the ECTS scale. Computer-aided testing is one of the most effective modern tools for measuring the academic achievement of higher education students.

**The aim of the study:** to explore the theoretical foundations of the use of ICT tools and to develop a means of controlling and testing knowledge to train future technical professionals.

**Object of study:** professional training of future specialists of technical profile.

**Subject of study:** the use of information and communication technologies in the preparation of future specialists of the technical profile.

**Hypothesis of Study:** Increasing the level of knowledge and skills of future specialists in the technical profile is possible through the use of information and communication technologies.

**Objectives of the study:**

1. To determine the theoretical basis for the use of ICT in the preparation of future specialists in the technical profile;
2. Develop a tool to control the knowledge of future specialists in the technical profile;
3. Experimentally test the effectiveness of the use of ICT in the preparation of future specialists in the technical profile.

**Research methods:**

- theoretical: analysis of scientific and psychological sources of information, which allowed to generalize and systematize scientists' views on the problem, study, systematization and theoretical analysis of literature and Internet sources;

- empirical: testing, discussions with teachers and higher education applicants, pedagogical experiment to test the validity of the working hypothesis;

- methods of mathematical statistics: at the stage of generalization, processing and interpretation of the results obtained during the experiment and determining their accuracy.

**Theoretical basis of the study** form the basic philosophical and psychological-pedagogical provisions on the leading role of information and communication technologies in the preparation of future specialists of technical profile.

**Scientific novelty and theoretical significance of the study** the first is to identify and substantiate the use of ICT tools in the preparation of future

professionals in the technical profile and the method of implementation of ICT tools in the process of training future professionals in the technical profile.

**The practical significance of the results obtained** the job is to develop a tool to control and test the knowledge and skills of future specialists in the technical profile.

## II. LITERATURE AND ANALYSIS

According to the academician of the National Academy of Pedagogical Sciences of Ukraine Gurevich RS the application of ICT in the educational process allows [3]:

- save study time;
- develop important life skills and functional life competencies;
- carry out mutual training between the teacher and the higher education applicant;
- to promote the development of creative thinking;
- Promote better presentation, memorization and learning of educational material through multimedia clarity;
- to destroy stereotypes;
- develop communication skills;
- to train everyone at their level;
- develop cooperation skills;
- make cross-curricular links;
- promote the development of computer technologies;
- to form an active cognitive activity of higher education applicants;
- makes you feel important and important, promotes the self-esteem of teachers and higher education graduates.

A similar approach is found in the scientific works of Bespalov PV, Bykov V. Yu., Zhaldak MI, Kademii Yu.

Professor Robert I.V. proposes to classify ICT tools by way of use in professional activity, namely [5]:

- as a learning tool that enhances the teaching process;
- as a tool for knowledge of the surrounding reality and self-knowledge;
- as a means of developing the personality of the educational recipient;
- as an object of study in the course of mastering computer science;
- as a means of information and methodological support and management of the educational process;
- as a means of communication;
- as a means of automating the processing of experiment results and control;
- as a means of automation of processes of control, correction, results of educational activity, testing and psychodiagnostics;
- as a means of organizing intellectual leisure.

### 2.1. Information and communication technologies: concepts, nature, types

Modern information technology is one of the most important and sustainable tendencies in the development of the world educational process. In recent years,

computer education and other ICT tools have become increasingly used in most educational disciplines in domestic educational institutions.

Informatization of society significantly influenced the process of knowledge acquisition. ICTs allow us to intensify the educational process, increase the speed of perception, understanding and depth of learning of vast masses of knowledge [1].

Information and communication technologies - a set of methods, tools for searching, storing, processing, presenting and transmitting graphic, text, digital, audio and video data on the basis of personal computers (PCs), computer networks and communications [2].

Today, the term «information and communication technologies» is also used to refer to the integration (convergence) of audiovisual and telephone networks with computer networks, and in educational institutions the term is used as a general covering the field of information systems and technologies for organizational level, software development and computer systems.

Information and communication technologies have become an integral part of the modern world, which determine the further economic and social development of mankind.

The use of ICT in the educational process is not accompanied by the replacement of «paper» media with electronic ones. They make it possible to combine the process of studying, generalizing, securing and controlling the acquisition of higher education material by the applicants. ICTs also allow individualization of the educational process.

The use of computer-based tests (CT) and diagnostic systems will allow the teacher to obtain an objective picture of the level of mastering the material studied by all higher education students in a short time and to correct it in a timely manner. It is possible to choose the level of complexity of the task for a particular higher education applicant. It is important for higher education students that immediately after completing the test (when this information has not yet lost its relevance), it receives an objective result indicating errors, which is not possible, for example, in an oral poll [7].

### 2.2.Analysis of international experience in the preparation of technical profile specialists

The most advanced national training systems for future technical professionals (including information security (IT) professionals) have been established in the USA, Germany, the United Kingdom, France and Austria, which is determined not only by their economies' needs, the development of information infrastructure and, accordingly, the information security system. geopolitical and military factors.

In Germany, HEI can independently establish compulsory (normative) subjects for study. For example, the general normative disciplines in the field of IB include: «Introduction to programming», «Fundamentals of physics and mathematics», «Theoretical informatics», «Analysis and numerical methods», «Software development», «Databases and control systems», «Information Security», «Data Structures and Algorithms». Regulatory specialties

include: Information Security Management, Electronic Keys, Mobile Security, Applied Cryptography, and more.

At the same time, higher education students can study different disciplines of their choice. As a rule, at the end of studies, the higher education student chooses one of the optional areas that contains several specialized courses (Computer Hacking, Internet Information Protection, etc.) that will determine his specialization.

As a result of an analysis of the specialties of HEI, it was determined that in the UK, training of future specialists in the field of IB is carried out in the following areas:

- computer security;
- legislation in the field of information systems;
- investigation of computer incidents;
- information technology security;
- security of computer networks;
- information security management.

But the most common and sought-after area of interest is the investigation of computer incidents.

The main disciplines of professional direction include: «Fundamentals of Computer Incident Investigation», «Computer Network Protection», «Information Systems Protection», «Programming Technologies», «Information and Communication Systems Security», «Information Security Management», « Legal and regulatory support for information security», «Computer hacking» and others.

A distinctive feature of the UK from other countries is that only in this country are higher education majors able to earn a master's degree in information technology.

Among the methods used in the educational process should be distinguished method «reverse». For example, in one of Scotland's universities, higher education graduates are taught to «hack computers».

The «Computer Hacking» course is one of the main stages in the training of future IT professionals. It is created on the basis of systematization and generalization of work of modern hackers. Higher education providers are exploring banking network penetration techniques and techniques for deciphering complex codes and more.

According to an analysis of HEI educational programs, in France, the training of future IS professionals is largely based on the study of information systems audit, network security and cryptography.

In general, the training of future specialists in IB is carried out in such areas as:

- information security management;
- audit information systems;
- security of information systems;
- network security;
- cryptography, etc.

The main disciplines of professional direction include: «Information Security Management», «Programming Technologies», «Fundamentals of cryptography», «Cryptographic protection of information», «Protection of information and

communication systems», «Protection of computer networks», «Databases», Audit Systems, etc.

A distinctive feature of France from other countries is that in this country applicants for higher education have the opportunity to get a thorough mathematical education, which is an integral part of the study of cryptography and computer security.

The most well-known HEI, which prepares future specialists in the technical profile in Austria, is the Vienna Technical University (Access mode: https://albioneducation.com/ua/vienna-university-of-technology-tu-wien-avstriya/). It is one of the three most prestigious universities in Austria, cooperates with the best technical HEIs in the world, and most importantly - provides a quality educational base, on the basis of which has grown "not one generation of famous entrepreneurs and reputable scientists.

As a result of the analysis of educational and vocational programs of HEI, it was determined that the Technical University of Vienna offers future specialists of technical profile training in such specialties as:

- informatics;
- economic informatics;
- technical informatics;
- medical informatics;
- media informatics;
- software engineering;
- systems engineering;
- information management.

The main disciplines of professional direction include: «Software development», «Databases», «Applied programming», «Data structures and algorithms» and others.

Unlike most Austrian universities, the Vienna University of Technology pays great attention to practical training. Higher education applicants are trained in industrial enterprises, participate in scientific development, work with orders of existing enterprises.

Higher education in Austria is different from higher education in other countries of the world, because in this country there are no summaries, daily lectures, seminars and tests. Higher education students study most of the material individually, and classes take only 2-3 days a week. Studying technical majors is combined with internships at technology companies, and one of the semesters is required to be outsourced to an international internship program for higher education applicants. This means that in addition to Austria, you can see life in another country and gain more experience.

The most well-known university that train future technical specialists in Poland are: Warsaw Polytechnic University (Access mode: https://www.pw.edu.pl/engpw), Wroclaw Polytechnic University (Access mode: http://pwr.edu.pl/en/), Tadeusz Kosciuszko Polytechnic University of Krakow (Access mode: https://www.pk.edu.pl/index.php?lang=en) and the Lublin Polytechnic University (Access mode: http://www.pollub.pl/).

In general, the training of future specialists in the technical profile in these HEIs is carried out in the following areas:

- information security;
- robotics;
- computer control systems;
- information systems in automation;
- engineering;
- electronics;
- telecommunications, etc.

The main disciplines of professional direction include: «Fundamentals of Physics and Mathematics», «Information Systems Protection», «Information Security Management», «Databases and Systems» and others.

The main emphasis in the preparation of future specialists of technical profile is on:

- creativity that changes the trajectory of the future;
- professionalism and hard skills.

A special feature of the training in Poland is cooperation with HEI of the leading countries of the world, such as: USA, Canada, China, Japan, Austria, Germany, Great Britain, Australia, France, Italy, Denmark, etc.

In the United States, great attention is also paid to the training of future IS professionals. The most popular and popular training programs in this country are those related to computer incident investigations, information security, computer security, and computer network security.

A distinctive feature of US education is the «flexibility» of the educational process, focused on the success of each higher education student in the formation of professional competence, accessibility to higher education, in particular. This «flexibility» consists in the formation of a personal curriculum, that is, a schedule of study of disciplines taking into account personal intellectual abilities, available experience, professional inclinations and preferences. At the same time, the number of regulatory disciplines in leading HEI is much smaller than the educational disciplines of the choice of higher education applicants, which allows each individual to plan his or her own system of training and professional development and lifelong learning more effectively. In addition, HEI implements a scheme of individual mentoring (Student Mentor) - assistance assigned to the applicant for higher education contact person in the planning and correction of the organization of training on an individual trajectory, taking into account the results of career guidance and wishes of the applicant of higher education in the distribution of their physical load own comfort during training.

In addition, the US recommends an online e-learning system for prospective IS specialists during bachelor's and master's degree programs, as well as postgraduate education.

The major disciplines taught to future IS professionals include: «Architecture and Security Models», «Data Security», «IT Operations Security», «Operating Systems Security», «Computer Security», «Network Security», «Network Security Management», «Cryptography», «Physical Information Security», «Information Security Risk Management», «Business Continuity» and «Disaster Recovery» «Information Security Audit», «IT Law and Ethics», «Cyber Law and Privacy privacy in the age of numbers of these technologies »[9].

For clarity, we present all the data in the Annex A, Table 1.2.

Therefore, as a result of the analysis of international experience, we can say that the training of future specialists in the technical profile (including specialists in IS) in Ukraine is carried out on the basis of generally accepted standards.

### 1.1 Design and implementation of ICT tools in the preparation of technical profiles

Explanation of theoretical principles of teaching technical disciplines by means of ICT is reduced to actual directions, which play a significant place in the development of educational process of applicants for higher education of technical specialties [10, p. 29].

By integrating ICTs into the educational process, depending on their technical capabilities, the higher education acquirer has access to a variety of broader information, which encourages his or her independent work. As evidenced by pedagogical practice, proper organization of independent work helps to activate the learning process [11, p. 45]. Moreover, independence in gaining more knowledge in practical classes using ICT hardware and software intensifies the formation of psychological, theoretical and practical readiness of higher education applicants for self-education, self-improvement. It is clear that the ability to self-education is an integral part of quality professional training of a specialist [12, p. 27].

The quality of training of future specialists in the technical profile, according to Professor Spivakovsky O.V., directly depends on the quality of education provided to him, and the quality of education - on the relevance of content and adequacy of pedagogical technologies. In the context of accumulating a large amount of information, it is natural to change the education system from "lifelong education" to understanding the need and possibility of "lifelong education". Informatization of education is aimed at finding the forms and content of the educational process, the introduction of computer-based teaching methods, which gives the opportunity to solve problems of higher education in the light of world requirements, to organize educational and cognitive activity of students and to form in the future professionals the experience of independent search for knowledge and their application in new conditions, to gain experience of creative activity [13, p. 76].

Information security specialists must possess certain general and professional qualities [14, p. 4]. The quality data are shown in Annex A, Table 1.3.

Effective implementation of ICT tools in the educational process is not possible without an adequate material and technical base. The HEI logistics base includes the university's computer network, local computer networks of faculties and departments. Laboratory and practical classes in the disciplines that involve the use of information technology are conducted in computer classes, usually equipped with modern computers. Most of the HEIs that provide technical profile training report free access to the Internet. For lecture classes, the department creates multimedia classrooms using a multimedia projector and a multimedia presentation board (usually created at MS Power Point), which helps higher educators to better perceive learning material, as it provides a visual and conducive to compelling material, charts, tables, etc. are also facilitated. Presentations can also be created not only to be displayed on a large screen for a student group in an auditorium , but they can

also be used for individual viewing on a computer and can be used both for teaching with the direct participation of the teacher and without his participation (for example, while performing the required amount of independent work provided by the curriculum of the discipline) [12, p . 28].

Also, appropriate software is required for effective implementation of the ICT education process, namely [12, p. 29]:

- operating systems and their administration tools;
- integrated software development environments;
- database management systems;
- CASE-software design tools;
- CAD-systems;
- computer graphics software products;
- office software;
- packages of mathematical and statistical applications;
- WEB technologies and etc.

ICT tools enable higher education providers to access unconventional sources of information - e-textbooks, teaching websites, cloud technologies, web services, etc., all of which make it possible to increase the effectiveness of cognitive self-development and provide new opportunities for creative growth of higher education applicants which contribute to the enrichment of the educational process with an emotional-visual form of cognition. However, it should be remembered that in teaching subjects using ICT tools, it is the teacher who manages the process and determines the duration of the use of technical means
[12, p. 29].

## III. DESIGN OF A COMPLEX OF ELECTRONIC EDUCATIONAL RESOURCES OF TRAINING IN PREPARATION OF TECHNICAL PROFESSIONALS

### 3.1 General requirements for complexes of electronic educational resources of training

The process of formation of the future qualified specialist of technical profile is based on the fact that a lot of information needs to be processed by the higher education qualifier, so the question of introducing electronic educational resources into the educational process arises.

The Electronic Educational Resource (EER) is a logically complete block of educational and methodological support necessary for the effective organization of educational and educational process, in part concerning its provision of quality educational and methodological materials [15].

The purpose of creating an EER is to modernize education, to substantially fill the educational space, to ensure equal access of the educational process participants to quality educational and teaching materials regardless of their place of residence and the form of training created on the basis of information and communication technologies [16].

According to the regulations on the procedure for granting the electronic educational resource the status of VSPU publication [17], the main types of EER include: electronic document, electronic publication, electronic analogue of printed edition, electronic didactic demonstration materials, information system, computer test, electronic dictionary, electronic reference book, e-tutorial, e-textbook, electronic methodological materials, electronic resources depository, electronic laboratory workshop, electronic library of digital objects and a distance learning course. A detailed description of each species is given in Annex B, Table 2.1.

Functionally, the EER is divided into [17]:

- educational and methodological EER (curricula, work programs of disciplines, developed in accordance with the curricula);
- methodological EER (guidelines, methodical manuals, guidelines for the study of a separate course and guidance on project work, thematic plans);
- EER training (online textbooks and tutorials);
- Auxiliary EERs (collections of documents and materials, directories, indexes of scientific and educational literature, scientific publications of teachers, conference materials, electronic directories, dictionaries, encyclopedias);
- EER for knowledge quality control (testing programs, test banks and coursework, and other EERs that provide for quality control of knowledge).

According to the order of the Ministry of Education and Science of Ukraine [15], the main requirements for EER are:

- functionality;
- safety;
- reliability of functioning;
- user-friendly;
- cross-platforming;
- compliance with the principles of implementation of the principles of the state policy of digital development;
- compliance with the laws of Ukraine on copyright protection;
- Compliance with International Standards (Experience API, etc.).

To summarize, we can conclude that ESDs help to systematically submit teaching materials and make them more accessible to higher education applicant.

### 3.2 Creating computer tests to train technical profile professionals

The introduction of ICTs into the learning process facilitates their penetration into the control process as an important and integral element of the learning process. The use of ICT also contributes to changing goals, content of training, including control, which causes the emergence of new methods, tools and organizational forms of learning and control. This, in turn, led to the transition of standard (blank) testing to computer testing [18].

The term «test» comes from the English word «test» and translates as a test or test. The test is a standard form task, the performance of which helps to identify certain knowledge, skills, abilities of higher education applicants and is determined by the following characteristics [19]:

- relative simplicity of procedures and equipment, direct fixation of results;
- the ability to use both individually and for the group;
- ease of processing;
- brevity.

Today, there is no institution of higher education that, to one degree or another, does not apply test methods to determine the level of knowledge of the applicant for higher education. For this purpose, special software containing a module for computer testing is used [20].

Computer Testing is an automated test based on specialized computer programs. It is used in conducting current, boundary and final control of knowledge of higher education applicants, in checking residual knowledge and in passing exam grades in relevant disciplines [21].

There are several types of computer testing, namely:

- entrance testing from a discipline;
- ongoing testing in the discipline;
- control module testing in the discipline;
- control module testing in the discipline;
- state testing certification testing.

Incoming and current computer tests are conducted during scheduled classes and are supervised by a teacher, and computer based computer tests are conducted outside scheduled scheduled training classes [22].

Computer testing is carried out in the form of an independent dialogue of the higher education student from the PC, in the presence of the teacher, with the possibility of saving the test results.

Computer-based testing is one of the most optimal means of control, which satisfies the requirements of objectivity of the obtained assessment, quality of the control process and has a positive impact on the motivation, interest of higher education applicants in the learning process as a whole [23].

The use of computer-based testing is an effective and up-to-date method of knowledge testing, which saves teacher time, arouses the interest of higher education applicants, encourages them to study the material qualitatively, and allows for an objective assessment. In addition, the quality of preparation of higher education students for the classes increases and their activity and organization during the independent processing of the material increases [24].

And:

- the teacher has the opportunity to objectively evaluate the applicant for higher education, since knowledge control is carried out by the program;
- every higher education student has the opportunity to evaluate their own knowledge;
- higher education students do not have the opportunity to use the supporting literature when answering because there is limited time for passing tests.

Compared to traditional testing, computer testing has several advantages that allow it [18]:

- use more sophisticated methods and algorithms to control and evaluate the knowledge of higher education applicants;

- use your computer's multimedia capabilities in test tasks;
- reduce the costs of organizing and conducting testing;
- reduce the time of testing a large amount of training material in a large group of respondents;
- get objective estimates with the exclusion of the human factor;
- increase the openness of the testing process.

The main component of any testing system is test tasks. The test task is a clear and clear task for the subject area, which requires a uniquely conditioned answer or a certain algorithm of actions, which together with the answer expresses the conformity (inconsistency) of knowledge, skills, skills tested by the selected criteria.

Computer tests to monitor and test the knowledge of future technical profile professionals in the Applied Programming discipline were developed by MyTestX.

MyTestX is a system of programs (Student Testing Program, Test Editor, and Results Log) for creating and conducting computer-based testing, collection and analysis of results, and grading on a test scale.

The system consists of three main modules, namely:

- MyTestEditor (test editor) - used to create the test (Annex B, Fig. 2.1);
- MyTestStudent (testing module) - used directly during testing (Annex B, Fig. 2.2);
- MyTestServer (test log) - can only be used when connected to a LAN, it generates a test result log.

MyTestX software supports four testing modes, namely: training, penalty, free and monopoly.

In training mode, the test taker displays his error messages, may be explained to the task.

In the penalty mode, points are deducted for incorrect answers, you can skip tasks (points are not added or removed).

In free mode, the test subject can answer questions in any sequence, go (return) to any question on their own.

In monopoly mode, the program window occupies the entire screen and cannot be minimized.

MyTestX works with such types of tasks as (Annex B, Fig. 2.3):

1) single choice;
2) multiple choice;
3) establishing a sequence;
4) establishing a compliance;
5) indication of the truth or falsity of statements;
6) choosing a place in the image;
7) enter the number manually;
8) enter text manually;
9) permutation of letters.

In our case, we used only the first 5 types of test tasks.

A single choice involves choosing one correct answer from several proposed. An example of a task with a single choice is shown in Annex B, Figure 2.4.

Multiple choice involves choosing one or more correct answers from several proposed (Annex B, Fig. 2.5).

Establishing a sequence involves arranging the list of statements in the correct sequence. To do this, for each answer, select its sequence number from the drop-down list. Drop-down lists are similar to menus. In the minimized state, this list displays only the currently selected option, other available options are hidden until the mouse button is clicked. An example of a compliance task is shown in Annex B, Figure 2.6.

Matching involves selecting the number of the appropriate option from all proposed (Annex B, Fig. 2.7). That is, two columns are given - for each variant from the first column it is necessary to specify the corresponding variant from the second column.

Indicating the truth or falsity of the statements involves selecting the statement "Yes" or "No" from the list for all proposed options.

An example of a problem to indicate the truth or falsity of statements is shown in Annex B, Figure 2.8.

To reduce the possibility of writing off, a random order of questions and answer options will be used.

A 100-point system will be used to assess the level of knowledge.

In total, the computer test developed by us contains 200 test tasks on various topics, but only 50 test tasks out of 200 at random will be used for the final control and testing of knowledge and skills of future technical specialists.

### 3.3 Methods of computer tests

The most important task of daily pedagogical work is the need to control and test the knowledge of higher education students. The most common forms of control and testing of higher education students' knowledge are written and oral surveys. But these forms have drawbacks.

For example, when conducting an oral interview, a large number of applicants for higher education do not participate in educational activities, in addition, a large amount of time is spent on oral interviews. And in the process of writing, a lot of time is spent on checking the work.

That is why the best means of control and testing of knowledge and skills of higher education, today, is computer testing, which meets all the requirements for the objectivity of the assessment and the quality of the control process [24].

The main requirements for computer tests are given in Annex C, Table 2.2 [26].

Computer-based testing systems enable a higher education student to assess the level of their knowledge and skills, and the teacher - to systematize and simplify the process of assessing the quality of knowledge and skills of higher education students.

Also, computer testing of higher education seekers allows you to quickly and efficiently:

- daily control and testing of knowledge and skills of higher education students in each class;
- control and testing of knowledge and skills of higher education students in the test (final) lesson;

- examination testing, etc.

In general, in pedagogy, computer testing performs three main functions that are interrelated, namely [27]:

- diagnostic;
- educational;
- disciplinary.

The diagnostic function is to identify the level of knowledge, skills, abilities of the applicant for higher education. This feature is basic in testing.

The educational function of testing is to motivate the applicant to intensify work on the assimilation of educational material. To strengthen the educational function, additional measures can be used to stimulate students of higher education, such as providing the teacher with an indicative list of questions for self-preparation, the presence of test questions and advice in the test, joint analysis of test results.

The educational function is manifested in the periodicity and inevitability of test control, which in turn helps to organize and direct the activities of higher education, identify and eliminate gaps in knowledge and form a desire to develop their abilities.

Computer testing is considered to be one of the fairest methods of monitoring and testing the knowledge and skills of higher education students, as it puts all higher education students on an equal footing, both in the process of control and evaluation, virtually eliminating teacher subjectivity.

In the process of studying the technical profile of the discipline "Applied Programming" by future specialists, we developed and used computer tests to control and test their knowledge and skills.

To begin with a higher education student, you need to run the appropriate CT scan in MyTestX. Then, a window will appear with information about the name of the test, the number of questions and evaluation criteria (Annex C, Fig. 2.9).

Next, you need to run the command "Test" - "Start" and enter the name and surname of the applicant. Then a window with the task will appear on the screen (Annex C, Fig. 2.10). you need to choose the correct answer and click "Next" to go to the next task.

After passing the test, a window with a score is displayed (Annex C, Fig. 2.11). In which two diagrams are shown, one with statistics of questions, the second - points.

The green color on the chart indicates the number of correct answers and points, and the red color indicates the number of incorrect answers and the number of points not scored, due to errors.

## V. CONCLUSIONS

In general, we present the results of theoretical and empirical research.

1. We have identified the theoretical foundations of the use of ICT in the training of future technical professionals. As a result of studying scientific sources on this topic, we can conclude that information and communication technologies include a set of methods, tools for finding, storing, processing, presenting and transmitting any kind of information using personal computers and the Internet.

Learning with the help of ICT is one of the most promising means of professionalism of future qualified technical specialists, as it allows future technical specialists to obtain the necessary data, differentiate and separate educational material, comprehensively perceive new information, repeat and consolidate knowledge and achieve self-realization. results. But the biggest advantage of using ICT in the educational process is that teachers and graduates can access the necessary knowledge anywhere, anytime.

As a result of the analysis of international experience in training future technical specialists, in particular such leading countries of the world as the USA, Great Britain, France, Germany, Austria and Poland, it was determined that these countries pay great attention to training technical specialists (including information security specialists). , due to the rapid development of informatization of society, as well as threats to information and national security of the country.

In addition, we can state that the training of future technical specialists (including IS specialists) in Ukraine is carried out on the basis of generally accepted international standards.

The effectiveness of the implementation of ICT tools in the training of future technical specialists, first of all, depends on the material and technical base of HEI, which should include the computer network of the university, local computer networks of faculties and departments, as well as appropriate software.

2. We have also developed a tool to control the knowledge of future technical specialists. To begin with, we considered the general requirements for complexes of e-learning resources, the main types of EER and identified the main requirements for the creation of EER, namely: functionality, security, reliability and ease of use.

The main advantage of EER is that they help to make learning material more accessible to higher education students.

Computer tests to control and test the knowledge and skills of future technical specialists in the discipline of «Applied Programming» were developed using the program MyTestX.

The main benefits of computer testing are that:

- the teacher has the opportunity to objectively assess the applicant for higher education, as the control of knowledge is carried out by the program;
- every graduate has the opportunity to assess their own knowledge;
- the quality of preparation of higher education students for classes increases and their activity and organization during independent processing of material increases;
- saves teacher time;
- the level of openness of the testing process increases.

In total, the computer test contains 200 test tasks, but only 50 test tasks out of 200 will be used to control the knowledge of future technicians.

3. During the experimental test we conducted a pedagogical experiment, which was conducted in four stages, namely: ascertaining, training, control and comparative. At the first stage, we conducted an input control of the level of knowledge and skills of higher education students of both groups. Later in the training phase, we introduced new teaching aids for EG, namely ICT tools. During the control phase, we conducted a final assessment of the level of knowledge and skills of higher education students in both groups. In the process of the

comparative stage we performed a comparative analysis of the level of knowledge and skills in the control and experimental group.

In total, 33 people took part in the experiment, forming a control group (16 people) and an experimental group (17 people). In the control group, the method of monitoring the knowledge of higher education students did not change, and in the experimental group, ICT tools were used.

Comparing the results of the level of knowledge and skills of higher education before and after the experiment, we can conclude that the number of higher education with high and sufficient levels of knowledge increased by 11.7%, and the number of higher education with low and satisfactory levels of knowledge, on the contrary, decreased by 11.6% and 17.5%, respectively. Which in turn indicates that the level of knowledge and skills of future technical specialists increases with the use of information and communication technologies.

Therefore, we have proved the effectiveness of ICT in the training of future technical professionals. We can say that the results of our study give reason to believe that the initial methodology is correct, the goal is achieved, the tasks are solved, the hypothesis is proven.

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The collection includes student works of the participants of the competition, which were not included in the number of prize-winners. The texts of the competitive works are published in the form in which they were submitted by the authors. The authors of the articles are responsible for the content and form of submission of the material.

**Responsible for the issue: Sergii Kotlyk**

**Computer typesetting and layout: Oksana Sokolova**

**Odessa 2021**