3. COMPLEX AUTOMATED COMPETITIVENESS DIAGNOSTIC SYSTEM OF FUTURE IT-SPECIALISTS

DOI: 10.31274/isudp.2024.151.03

Liliya Ivanova

The article presents an automated computer system for diagnosing the competitiveness of future specialists in information technology, which consists of a set of tests for determining the psychological, creative and personal qualities of an education seeker. It was determined that the application of a complex approach to system diagnostics using multi-directional tests allows obtaining a systematic assessment of the components of the competitiveness of future specialists in dynamics. The use of an automated computer system for the diagnosis of the student’s personality for the assessment and attestation of the psychological state of students of educational institutions of various accreditation levels, the identification of personal and professional characteristics, which will allow quantifying the level of competitiveness of future information technology specialists and greatly simplifies the recording and processing of the respondent’s answers while simultaneously reducing the probability of errors at a certain stage of diagnosis. The functions of an automated computer system for diagnosing the competitiveness of future information technology specialists are considered. The structure of the blocks of the automated computer system for the diagnosis of competitiveness is presented. The results of an experimental study of the competitiveness of students of the Odesa Technical Vocational College using an automated computer system for diagnosing the competitiveness of future information technology specialists are presented. It is proposed to use an automated system for diagnosing and evaluating the creative, psychological and personal components of students’ competitiveness for the work of structural divisions of the educational, psychological and educational direction in educational institutions of different levels of accreditation to determine the level of formation of key personal qualities of education seekers.

INTRODUCTION

In the conditions of the multifaceted development of our country, an irreversible process of modernization of the entire education system is taking place, the main goal of which is the training of a competitive specialist of the appropriate level and profile, who is fluent in his specialty and oriented in related fields of activity, capable of effective activity in his specialty at the
level of world standards, ready to continuous professional development. Today, competitiveness is considered as a sign of a modern specialist.

The problems of the national education system have recently been constantly under the watchful eye of all sections of the public. Ukrainian higher education loses to the Western education system in terms of providing students with knowledge and forming practical skills: if everything is relatively safe with theoretical foundations in Ukrainian higher educational institutions, the practical knowledge of graduates and tomorrow’s specialists is clearly insufficient.

The ideas of general and personal development, formulated in the context of psychological and pedagogical concepts of developmental and personally oriented education, are a genetic prototype of modern ideas about competences, which are considered as transversal, extra-, extra- and meta-subject education, integrating both traditional knowledge and various kind of generalized intellectual, communicative, creative, methodological, worldview and other skills.


A large number of studies are devoted to the study of trends in the development of higher education in the conditions of a change in the educational paradigm and the formation of professional competence of a specialist (H. Artyushin, L. Baranovska, V. Bobrytska, N. Bulgakova, I. Zarubinska, O. Kevtun, A. Kokareva, O. Kotykova, N. Ladogubets, V. Lugovoi, E. Luzik, L. Pomytkina, T. Sayenko, V. Semichenko, etc.); definition and development of theoretical and methodical foundations of continuous professional education (O. Volosovets, S. Honcharenko, L. Huberskyi, V. Kremen, L. Lukyanova, N. Nychkalo, S. Sysoeva, N. Ridey, etc.), study the personality of the future competent specialist and the issue of professional training of an IT professional (N. Bulgakova, M. Zgurovskyi, G. Kozlakova, V. Kruglik, P. Luzan, E. Luzik, V. Osadchyi, T. Sayenko, A. Eckerdal, M. Caspersen, C. Masuck, J. Miller, N. Truong, etc.).

90
“IT specialist” includes a number of different professions, the responsibilities of which are very different and depend on the specific position. Conventionally, all information technology specialists can be divided into those who work with “hardware” and those who deal with “software”. The digital environment is developing rapidly, so the list of IT professions is constantly updated with new specialties. Also, various technical devices and information systems are constantly being improved and updated, which requires a high level of knowledge and skills of IT specialists, their mobility, constant self-development and self-improvement.

Intensive development of information technologies is predicted, therefore the demand for IT specialists is constantly growing. In order to achieve success and earn good money, you need to master the most relevant areas and keep your finger on the pulse of the latest trends. And for this, IT specialists need to be psychologically ready to implement new technologies, to perceive and master innovations, to demonstrate flexibility and a creative approach. And that is why the formation of professional competence of IT specialists is the main condition for effective professional activity in a high-tech innovative society.

According to the Exploring Ukraine IT Outsourcing Industry study, Ukrainian educational institutions annually graduate about 16,000 specialists in the field of information technologies [1]. However, supply and demand in the information technology market remains unbalanced. And every month, Ukrainian IT companies publish about three thousand new vacancies. Unfortunately, nowadays it is more and more common to talk about the inconsistency of the existing system of training specialists with the real requirements of the market and, in particular, in the field of information technologies. A. Yavorskyi, vice president of the GlobalLogic company, claims that “the number of young professionals capable of working in IT is currently sufficient, but their quality plays an equally important role. Unfortunately, the modern education system in Ukraine does not keep up with trends in the field of IT technologies.” Y. Lyubinets, chairman of the board of directors of Soft Serve, agrees with this opinion. The Managing Director of Luxoft Ukraine O. Alkhimovych notes that educational institutions do not give young professionals an understanding of business requirements due to outdated training programs. She noted that “the market needs specialists who work on the edge of innovative solutions, who know how to think, create, create complex creative solutions” [2].

On the “Professional Consulting Portal” [3], the professional profile of an information technology specialist is presented. In essence, this is a
document that provides a comprehensive, systematized and comprehensive description of the objective characteristics of the profession and the requirements for individual psychological characteristics of a person. The list of personal qualities that ensure successful performance of professional activities in the IT industry includes the following: responsibility, attentiveness, patience, diligence, systematic work, accuracy, logical thinking, tenacity, perseverance, flexibility and dynamic thinking, the ability to make decisions independently, purposefulness, technical abilities, mathematical abilities, analytical thinking.

The professional activity of a specialist in the field of information technologies (in primary positions) consists in: implementation of general functions of planning and management by implementing partly administrative and mainly operator work procedures; collecting, systematizing, and accumulating primary information both for the performance of his job duties and for the needs of the structural unit where he works; development and research of predictive mathematical models of organizational-technical and socio-economic objects and systems for the purpose of their analysis and improvement; making operational decisions within their competence; functional and informational preparation of draft solutions; management of subordinates whose competence is not higher than that of technical employees or junior specialists; carrying out an assessment of the potential of computer hardware and software; organization and control of the functioning of the information system in these operations of the technological process of information processing; development of software for professional activity tasks using high-level programming languages and database management systems [5].

In fact, during personnel selection, the applicant’s compliance with the requirements is checked, which are divided into two categories: “hard” and “soft” requirements.

“Hard requirements” (professional qualities or “hard skills”) are professional abilities, skills and knowledge that are necessary for the performance of professional tasks. They can be measured and evaluated objectively. They are related to knowledge of fundamental and special disciplines, acquisition of practical training, etc. For an IT specialist, these can be: deep knowledge of programming languages; ability to create algorithms; knowledge of operating systems, software architecture; software and hardware coding and testing; software debugging; knowledge of software development process methodologies; knowledge of English; ability to create technical documentation, etc. But they depend significantly on the company’s field of activity and may differ.
“Soft” requirements (personal qualities or “soft skills”) combine a number of psychological characteristics, properties and skills that can be grouped. These qualities are difficult to measure, and therefore their evaluation is subjective. Most employers consider them as important as professional knowledge and skills. Professional skills and abilities become obsolete, and “soft skills” are always relevant. According to G. Babii, personal qualities are a complement to professional qualities, and professional qualities determine those personal qualities that a specialist must have or develop in himself for professional growth [6].

Basically, soft skills are skills, abilities and characteristics that allow you to be successful in professional activities. These include: leadership qualities and the ability to work in a team, the ability to teach and negotiate, the ability to set and achieve goals, time management, goal orientation, presentation skills, effective communication skills, stress resistance, creativity, a creative approach to solving tasks and analytical abilities, etc. There is no fixed list, just like the classification of soft skills. Because it is clear that different types of soft skills are prioritized for different types of activities.

Information technologies are becoming one of the most important tools for forming needs, interests, views and value attitudes, influencing the worldview of a person; act as a mechanism of education and training and, in general, are a means of forming professionally important qualities of a specialist. Professional training of highly qualified specialists in the IT field, employed in industry, business, scientific centers, becomes a strategically important task that requires the maximum use of achievements of scientific and technical progress, a comprehensive approach to planning the educational and scientific-methodical process, bringing methods, means and forms learning according to the demands of modern life.

One of the global tasks of training an IT specialist is the formation of abilities and skills to navigate in a huge flow of information, to quickly reorganize one’s activities in accordance with modern requirements in the conditions of informatization, to master new technologies and knowledge.

The field of information technologies and telecommunications is characterized by rapid development, and in order to maintain the gained pace, specialists who would help it in this are becoming more and more necessary. At the same time, specialists should meet certain requirements, without which they will not be able to successfully cope with their professional tasks. Such specialists must first of all be inclined to mathematics, informatics and working with technology, including computers. They need to have an analytical mind, a good memory and the ability to work with a large amount
of information. Also, irreplaceable qualities for all employees in this field, regardless of position, are responsibility, organization, stress resistance, and the ability to study independently from specialized literature.

It is worth noting that the image of an IT specialist who worked, for example, ten years ago, is significantly different from today. Now he is not a silent, focused person who does not take his eyes off the computer all day, but a sociable employee, ready to work in a team and have a direct dialogue with customers. When creating a product, IT and telecommunications workers focus on its future consumers, so they know the interests and needs of their potential customers well.

It is important not only to have all these qualities, but also to present them correctly, for example, during employment. The main business card here is a resume, in which you should definitely indicate your advantages and abilities. “LinkedIn” — a social network for establishing business connections — studied the resumes of IT specialists and made a list of the most frequently used qualities:

- analytical mindset — 6.5% of applicants;
- ability to work in a team — 4.3% of applicants;
- hard work — 2.5% of applicants;
- the ability to work with a large amount of information — 1.9% of applicants.

Holders of such qualities really have many chances to find a job in their specialty, especially since the demand for workers in the field of information technology and telecommunications significantly exceeds the supply. Of course, in order to be competent and in demand, they will need not only a psychological inclination to the profession. They cannot do without a good education, professional knowledge and skills, constant improvement of their skills. And knowledge of the English language, besides, will help to find a job in an already known or very promising foreign company.

The analysis of the specifics of the tasks in the field of information technologies and the question of the professional qualities of IT specialists were at different times dealt with by psychologists and educators from abroad — F. Brooks, G. Weinberg, N. Wirth, E. Dijkstra, S. McConnell, M. Smulson, B. Schneiderman and others, who claim that professional IT specialists have their own psychological and human traits, qualities and determine the abilities and features of thinking that should be characteristic of them.

The analysis of the practical activities of modern specialists in the IT field makes it possible to identify a kind of “standard of professional competence of IT specialists”, which can be presented as a set of knowledge and
skills that an information technology specialist must possess for successful professional activity:

1) highly specialized competencies that allow creative use of computer programs, various “software packages”, utilities and gadgets in the process of solving emerging problems;

2) knowledge of a wide range of programming languages and the ability to use them in the process of joint organizational activities when solving set tasks;

3) the ability to enter a special mode of information activity, which involves focusing consciousness on symbolic information and transforming the received information into organizationally significant information / knowledge;

4) the ability to integrate into a single field of the organization the information produced during the operation of computer networks with the information circulating through other channels of intra-organizational information /

Despite the importance of the qualification factor of IT specialists, their internal group status and internal organizational perception are largely determined by such important individual parameters as the type of temperament and personality traits. In the studies of Yu. Babayeva and A. Voyskunsky, the following two groups of professionally important qualities are given: personal and communicative [3]. According to O. O. Gurska, the set of the most expected personal qualities that modern IT specialists should display should include emotional stability, punctuality, accuracy, thrift, high efficiency, the presence of extreme attentiveness and logic in thinking. The factor of passion for work and high professional motivation is also of great importance, because without a sustained interest in everyday professional activities, it is impossible to count on internal positive motivation, which, according to the point of view of researchers F. Brooks and M. Smulson, is closely related to a feeling of joy, with a feeling of absolute freedom of creativity, which IT specialists are able to feel in the course of their work.

Summarizing the theoretical and practical studies discussed above, it can be stated that IT specialists must have a set of mandatory abilities based on a combination of certain psychological characteristics, namely:

1) the ability to carefully consider one’s professional actions, their expediency and safety in view of the high risk of irreversible consequences of professional mistakes, and also to take responsibility for their results;

2) the ability to long-term and high-level intellectual concentration of activity, in which various manifestations of psycho-emotional and phys-
iological discomfort are possible due to monotony, low and monotonous physical activity, which is based on a combination of a high level of intellectual abilities, emotional-volitional self-regulation and a balanced type of temperament;

3) the ability to convey one’s thoughts in a language understandable to ordinary users-colleagues (who are not specialists in the IT field) when explaining the rules of working with computer / software equipment and operating systems, which is based on a combination of a high level of development of social intelligence and basic communication skills;

4) the ability to react in an emotionally balanced manner to possible mistakes of colleagues and direct supervisors that arise in the process of their work with office computer programs, networks, and in an accessible, correct form to explain everything they need to know in order to avoid similar mistakes in the future, which is based on a combination of a high level of development of emotional self-control and appropriate communication skills.

Today there are many different areas of professional activity of IT specialists, which have their own characteristics and require deep knowledge in the field of information technologies: programmer; system architect; specialist in information systems; system analyst; system administration specialist; information technology manager; manager of sales of solutions and complex technical systems; specialist in information resources; database administrator.

The conducted analysis showed that today employers need specialists with work experience and an available range of professional knowledge, with developed personal skills that significantly increase work efficiency. This position is confirmed by the results of studying resumes and vacancies on specialized resources and websites of leading employers in the IT industry.

**Formulation of the problem.** The study of competitiveness as an integral property of the individual, the dynamics of its development in the process of professional formation, the possibility of discovering new reserves of the individual, is gaining relevance and requires in-depth study.

The study of competitiveness as an indicator of the quality of training of specialists is devoted to the works of R. Fathutdinov, D. Chernilevsky, S. Shirobokov, D. Bogyna, N. Hlevatska, O. Grishnova, M. Krymova, O. Krymova, L. Lisohor, M. Semikina, S. Sotnikova, N. Shulgy. In foreign pedagogy, the problem of specialist competitiveness became the subject of research by R. Kvasnytsia, V. Landsheer, M. Lennon, P. Mercer, M. Robinson, and others. In the studies of O. Dushkina, M. Knyazeva, M. Mashnikov, V. Oganesov, and M. Semenova, problems of the development of
the personality of a specialist were considered. The structure and characteristics of competitive personality qualities are considered in the works of I. Drach, G. Dmytrenko, V. Andreev, N. Borisov, E. Klimov, A. Markova, and L. Mitina. L. Mitina’s research presents the psychological aspect of the development of a competitive personality.

It should be noted that in various countries there is an ongoing dialogue between employers and educational institutions regarding the definition of personal and professional skills that can become key for a specialist. This issue is also being studied in Ukraine. The World Bank’s “Skills for Modern Ukraine” study (2019) showed that there is a significant demand in Ukraine for developed cognitive skills, self-organization, resilience, teamwork and willingness to learn. This list has not undergone significant changes in recent years. Thus, according to a study conducted by the CSR Development Center during July-August 2021, the following skills are in greatest demand among Ukrainian employers: the ability to work in a team, communication skills, analytical thinking, the ability to learn quickly, flexibility, responsibility, initiative, competent written and oral language, emotional intelligence. At the same time, in the perspective of 2030, according to the same respondents, the greatest demand will be for critical thinking and a project approach to solving problems. An important place in the system of requirements for the training of a future specialist is occupied by appropriate psychological characteristics, personal and professional qualities that could ensure a high level of competitiveness in the modern labor market.

The problems and features of training future specialists in information technologies were considered in their studies by many domestic and foreign research scientists, in particular A. Vlasyuk, T. Hura, L. Grishko, L. Dobrovskaya, L. Zubyk, O. Kaverina, T. Kovalyuk, L. Kurzayeva, I. Mendzebrovskiy, T. Morozova, O. Pavlov, V. Sedov, D. Shchedroloesiev and others. The question of compliance of the existing standards of training of IT specialists with the requirements of employers was also investigated (O. Pavlov, T. Kovalyuk, P. Pavlenko, S. Popershnyak, V. Osadchyi).

In the works of T. Gur, L. Dobrovskaya, O. Kaverina, T. Kovalyuk, V. Medved, D. Mustafina, attention was paid to the problem of forming the competitiveness of graduates of technical universities, software specialists, and software engineers.

The basis of the new standards of higher and professional higher education of Ukraine in the field of knowledge 12 “Information technologies” are Computer Science Curricula documents, which regulate the process of
training IT bachelors in the USA and other countries [7]. In turn, the developers of Computer Science Curricula focused on the recommendations of world leaders in information technology, namely the Institute of Electrical and Electronics Engineers (IEEE) and the Association of Computer Engineering (ASM).

Determining the personal qualities and characteristics necessary for a future IT specialist to effectively solve production problems, taking into account the requirements of all interested parties — employers, state and private institutions, educational institutions — requires a comprehensive approach of system diagnostics using multi-directional tests, which will allow obtaining a system assessment components of the competitiveness of future specialists in dynamics.

Diagnostics should be based on clear and precise ideas about the essence of this process. Psychologists, unanimously recognizing that the phenomenon of personality itself exists and is one of the basic objects of research in psychological science, also unanimously believe that the problem of objectively defining the essence of personality and its interpretation is one of the most difficult.

The diagnosis of the formation of competitiveness can be implemented using a set of complementary methods and techniques, namely:

– surveys and interviews during which the opinions of students, teachers and specialists on the problem of competitiveness and determination of the list of priority professionally important and personal qualities of a competitive specialist in information technologies were revealed;

– observation, the purpose of which was purposeful and systematic perception of the actions and behavior of future competitive IT specialists;

– self-assessment, in the process of which the level of formation of personal qualities of a competitive information technology specialist was determined;

– testing that revealed the level of professional knowledge, abilities and skills of the future IT specialist.

The principle of diagnostic efficiency is provided by the use of a number of methods that allow assessing the level of formation of the components of students’ competitiveness, for example, expert evaluation, testing, individual and group interviews, and others. The selected diagnostic device allows you to measure the level of formation of the components of the competitiveness of future IT specialists and quickly process the results.

The principle of objectivity — diagnosis should be based on scientifically based criteria and indicators of the competitiveness of future IT specialists.
The developed evaluation tests were composed in accordance with the evaluation object and were based on the theory of pedagogical testing.

Levels of formation of the components of the competitiveness of future IT specialists by components [8]:

1. Motivational and value component

*Low.* The student has a weakly expressed need to achieve success, gain knowledge for future professional activity, expand his horizons, self-education, updating his own experience, the student needs constant encouragement and control. The student does not show activity, does not strive for successful activities, does not know how to build life and professional priorities.

*Average.* The student has a pronounced need to achieve success, gain knowledge for future professional activity, expand his horizons, self-education, updating his own experience, but the student needs a certain encouragement. The student is active and strives for successful activities, knows how to build life and professional priorities.

*High.* The student has a clearly expressed need to achieve success, gain knowledge for future professional activities, expand one’s horizons, self-education, update one’s own experience. The student is active and strives for successful activities, knows how to build life and professional priorities.

2. Cognitive component

*Low.* The student has a low level of formation of professional knowledge.

*Average.* The student has an average level of formation of professional knowledge.

*High.* The student has a high level of formation of professional knowledge.

3. Active component

*Low.* Low level of generally recognized practical professional skills and abilities.

*Average.* Sufficient level of generally recognized practical professional skills and abilities.

*High.* High level of generally recognized practical professional skills and abilities.

4. Personal reflective component

*Low.* The student does not show persistence and initiative; however, can be attentive, diligent, disciplined, rarely shows independence and autonomy in decisions; does not know how to adequately evaluate his own achievements and predict the consequences of future activities, takes criticism with difficulty and does not always respond to criticism with restraint.
Does not know how to organize and plan his own employment; does not show creativity, acts according to an algorithm; not communicative, does not know how to think logically and justify his own judgments, analyze information; not mobile, passive; has a limited range of ideas; hard to adapt to the new; needs constant control, rarely takes responsibility, withdrawn, has a low rate of development of technical abilities. *Average.* The student shows persistence and initiative in achieving the goal, depending on the situation; attentive, diligent, disciplined, can show independence and autonomy in decisions; is able to adequately assess one’s own achievements and opportunities, predict the consequences of future activities, reacts to criticism with restraint. Able to organize himself and others for successful activities and plan his own employment; sociable, open to communication, likes to be the center of attention; shows creativity and unconventionality when solving professional tasks; knows how to think logically, but cannot always substantiate his own judgments and analyze information; sufficiently mobile, has a broad outlook that goes beyond the specialty, but has a limited range of ideas; able to work in a team, can defend his own views, but sometimes experiences difficulties in adapting to new things; has an average indicator of the development of technical abilities.

*High.* The student shows persistence and initiative in achieving the goal, is attentive, diligent, shows independence and autonomy in decisions, is disciplined; knows how to adequately evaluate own achievements and opportunities, predict the consequences of future activities, adequately responds to criticism. Able to organize himself and others for successful activities and plan his own employment; sociable, open to communication, likes to be the center of attention; shows creativity and unconventionality when solving professional tasks; is able to think logically and justify his own judgments, analyze information; mobile, has a broad outlook that goes beyond the specialty; able to work in a team, can defend his own views; does not experience difficulties in adapting to the new; has a high rate of development of technical abilities.

The *purpose of the article* is to present an automated complex system for diagnosing the student’s personality, consisting of a set of tests for determining the psychological, creative and personal qualities of the student; for assessment and attestation of the psychological state of education seekers, identification of personal and professional characteristics, which will allow to quantitatively determine the level of the personal component of the competitiveness of future information technology specialists.
3.1. AUTOMATED COMPETITIVENESS DIAGNOSTIC SYSTEM OF FUTURE INFORMATION TECHNOLOGY SPECIALISTS

For diagnosis and evaluation of competitiveness, an automated system of diagnosis is proposed, which is a computer system of personality diagnosis, consisting of a set of tests for determining the psychological, creative and personal qualities of a future specialist. The system can be used to assess and certify the psychological state of school students, identify personal and professional characteristics. The use of modern computer technology provides new opportunities for diagnosing an individual or a group. The recording and processing of the respondent's answers is greatly simplified, while at the same time reducing the probability of errors at this stage of diagnosis (which are practically inevitable during manual processing). A significant advantage of computer tools for psychological and professional diagnostics is the speed of conversion of the received primary data into standard values.

Task:
1) present an automated computer system for diagnosing the competitiveness of future information technology specialists, consisting of a set of tests to determine the psychological, creative and personal qualities of the listener.

2) experimenting verify its effectiveness.

Functions of the automated system for diagnosing the competitiveness of a future IT specialist: diagnostics, collection and analysis of test results, saving the results in the database, forming a report according to the diagnostic results in the format of an Excel table.

The automated system for diagnosing the competitiveness of future IT specialists is a desktop application running on the Windows operating system, which is implemented in the C# programming language with support for Windows Forms technology, which is one of the most popular technologies for developing Windows windowed applications.

The comprehensive automated system for diagnosing the competitiveness of future IT specialists is a computer program with 16 available tests. According to the principle of passing the tests can be divided into two categories: “question-answer” and “identification of priorities”. According to the content of the questions, the tests are divided into: text and text with the use of graphics. The complex of diagnostic tools is determined on the basis of the analysis of scientific works and dissertation studies of the psychological and pedagogical direction on the study of the phenomenon of “competitiveness” [4].
In general, the structure of the program “Computer diagnostics of personality” can be divided into three main blocks: registration block, testing block, administration block.

The registration block is the first window of the program and consists of several test fields in which the person being tested enters basic data, such as last name, first name, patronymic, group and gender. The program al-
algorithm checks the data entered by the student. For example, in the last name, first name, patronymic and group fields, it is not allowed to enter any symbols and letters, except for the Cyrillic alphabet and the “-” sign, and the algorithm takes this into account.

![Fig. 3.2. Registration window](image)

After clicking on the “Start testing” button, the program, according to the algorithm, checks whether all the fields with the surname, first name, patronymic and group are filled in, if at least one field is empty (not filled), the program displays a window with the error text “Fill all fields!” If all the fields are filled in, the registration window is closed, and work with the unit is considered completed, and the test selection window, which is related to the test unit, opens.

The test block consists of eighteen windows, one for test selection, one window for displaying test results, and sixteen windows that directly display each of the sixteen tests.

First, the test selection window is displayed, on which there are sixteen buttons. When you click on one of the buttons, a window with the corresponding test number opens. All tests are divided into two types: question-answer and prioritization.

In tests with a “question-answer” structure, the window displays the question and a list of possible answers next to it. In the list, the user has the opportunity to choose one of the answers.
Professional and personal qualities of a competitive IT specialist are important.
Diagnosis of the realization of the need for self-development

Diagnosis of the degree of critical thinking
Collectivism or individualism

Diagnosis of reflection
Questionnaire of the level of formation of personal qualities of students

Express diagnostics of organizational abilities
A test to determine the level of sociability

Test on the level of your sociability (recommended by V. Rakhovsky)

1. Are you a typical person or do you have a different kind of personality?
2. Would you delay your visit to the doctor until the last moment?
3. Do you agree that your opinion is not always the same?
4. Are you willing to take risks?

Diagnosis of the degree of readiness for risk

Methodology of the level of readiness to take risks (by Shubert)

1. Are you satisfied with the way you handle risks?
2. Have you ever been in a dangerous situation?
3. Have you ever been in a hazardous environment?
4. Have you ever been in a hazardous situation?

108
Rigidity determination test

Assessment of the level of development of technical thinking
Assessment of the level of creative potential of an individual

A test to determine the characteristics of thinking
In tests with a “prioritization” structure, a statement is displayed in the window and next to it — a list with the place where this statement should be placed. When choosing a position of an assertion in the priority list, this position becomes unavailable for other assertions.

The algorithm of the program provides for checking whether the answer is selected from all the lists. If the answer to even one question is not selected, the program displays an error window with the text “Fill in all the answers!”, otherwise the process of processing the test results begins.

The process of processing the results is divided into several stages. The first stage is the direct calculation of the number of points for the past test. The scoring scheme for each test is different. In tests where there is only one correct answer, points are awarded for choosing this answer. In addition, there are tests where there is no correct answer, and the student must simply evaluate this or that statement, in which case points are awarded according to the student’s evaluation.

The second stage of processing the results is determining the level of the test result. The results of each test are reduced to a three-level scale, depending on the number of points scored (high, medium and low level),
the higher the level, the higher the student has developed the quality that the test was aimed at identifying. In tests with a “prioritization” structure, points are not calculated, the process of processing the results consists only in saving the selected place in the list of priorities for each of the statements.

Fig. 3.5. Test results window

The conservation stage is the third stage. During the third stage, the results are stored in the database. This process consists of connecting to the database, forming the query text to the database, executing the command with the query text to the database (step of saving the results directly), and closing the connection to the database. If an error occurred at one of the stages (for example, there is no Internet connection or the administrator entered incorrect data for connecting to the database), the user will see an error with the text: “Error connecting to the database. Check your network connection or contact your administrator”, the results are not saved to the database, but may be saved later when connecting to the database. The stage of saving the results to the database takes place in parallel with the execution of the program, so the student has the opportunity to freely use the program simultaneously with the process of saving the results.

After passing the test, the test selection window opens again to the user. At the same time, the passed test will be marked as completed. It is not pos-
sible to pass the same test in one session. The program provides an opportunity to view the results after the test, a test results window will open where the user can view his results for all the tests he passed (the number of points scored and their expression on a three-level scale). The user cannot see the results of the tests with the “prioritization” structure, because he does not have these results by definition. The Back button on the results panel returns the user to the test selection panel. In addition, after passing another test, the value of the progress scale, which reflects the degree of passing the diagnosis, increases.

If, due to connection problems, the program failed to save all diagnostic results, when it is closed, according to the algorithm, a warning will be displayed with the text: “Not all results were saved, are you sure you want to close the application?” with two buttons for answering “Yes” and “No”. If the user clicks the “No” button, the script will try again to save all unsaved diagnostic results. If the user selects the “Yes” option, the program will complete its execution.

Administration block. This block is a technical part of the program that is not accessible to the normal user (the one being tested), access to this part of the program is only available to the administrator (the person who conducts the diagnosis), based on this, to ensure security to access the administration panel, you must enter password. The first thing that a person who opens the administrator panel sees is a field for entering a password, a button for confirming the password entry, and a button for changing the password entry mode (hide the characters that are entered or display them). If the user entered the password correctly, the elements for entering the password will disappear, and the main part of the administrator panel will appear, if the password was incorrect — access will be denied until the user enters the correct password.

The admin panel is divided into two parts: the settings block, the results selection block.

The settings block consists of several text fields that are used to enter such information as the database server address (host), database user name, database name, database access password, and administrator panel access password. In the program, a password for accessing the administrator panel is set by default, the administrator can optionally change this password by writing a new password in the text field “password for accessing the administrator panel”.

In addition, this block has two functions “Save settings” and “Check connection to the database”. The “Save settings” button saves the entered
data for connecting to the database and the password for accessing the administrator panel in a special service configuration file, which is located in the same folder as the program itself. The button “Check the connection to the database” starts the script for checking access to the database according to the entered settings, if the connection was successful, the program creates empty tables in the database in which the results of the diagnostics will be stored and displays a window with the message “The connection to the database was successful!“. If it was not possible to connect to the database, the program will display an error window with the text: “Error connecting to the database. Check your network connection or contact your administrator.”

The block of selection of results consists of one list and three text fields and serves to assign parameters for forming diagnostic results. In the list, the administrator selects the number of the test, the results of which he wants to receive, in addition, the student’s name can be entered in the text fields, if the administrator wants to see the results for an individual student, group number, if the administrator wants to see the results for an individual group, and gender (all parameters can be combined among ourselves). After pressing the “Send request” button, a request to the database is generated according to the parameters set, if the data corresponding to the specified parameters exists, the process of generating results begins.

The process of generating the results begins with the display of a window for choosing the storage location and the name of the file in which the results will be recorded. If the file in which the user wants to save the result file already exists, a warning will be displayed about this, if the user agrees — the file will be overwritten. Next, a new Excel book is created, in which data about students and their diagnostic results are recorded, according to the received data according to the specified parameters. In addition, the file records the number of students who received a high, medium and low level from the selected test, as well as statistics separately for boys and girls. According to these statistics, a histogram is built, which has nine columns.

After generating the results, the file is saved and becomes available for reading and editing by the user.
3.2. RESULTS OF THE AUTOMATED COMPETITIVENESS DIAGNOSTIC SYSTEM OF FUTURE INFORMATION TECHNOLOGY SPECIALISTS

The automated diagnostic system was used in the course of research and experimental work on the topic “Formation of the competitiveness of future information technology specialists in technical colleges” [3].

Students of Odessa Technical College participated in the experimental study. The control group (CG) of students studied according to the traditional system, for the experimental group (EG) pedagogical methods were applied, which contribute to the formation of the competitiveness of future information technology specialists in the process of professional training [4].

After the completion of the formative experiment, the students of the control and experimental groups were diagnosed with the help of an automated system for diagnosing the competitiveness of future specialists in information technologies according to two criteria that are structurally determined by the psychological, creative and personal qualities of the future specialist, namely motivational-value, cognitive, personal-reflective, professional and activity criteria.

The final analysis was carried out on the basis of the methods used at the diagnostic stage of the experimental work. After the mathematical processing of the collected empirical data, the results of the formation of the main indicators of the competitiveness of future specialists in information technologies according to the criteria look as follows.

The results of diagnostics based on motivational-value, cognitive, personal-reflective, professional-activity criteria after the diagnosis is completed are presented in tables 3.1–3.5.

According to the results of the automated system for diagnosing the competitiveness of future information technology specialists, as evidenced by the analysis of the overall result, there is an improvement in indicators in the experimental group, which characterizes the number of students with high and medium levels, and a reduction in the number of students with low levels. We can state an increase in the level of competitiveness of future information technology specialists based on motivational-value and personal-reflexive criteria, both in the experimental and control groups. However, small results indicate that it is necessary to further introduce new learning technologies into the educational process, to search for effective ways to increase the competitiveness of future specialists.
The results of the diagnosis of the formation of the competitiveness of future IT specialists according to the motivational and value criterion after the completion of the formative experiment

<table>
<thead>
<tr>
<th>Indexes</th>
<th>%, at the ascertainment stage</th>
<th>%, at the formative stage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>KG</td>
<td>EG</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>A</td>
</tr>
<tr>
<td>the presence of motivation for development, self-improvement</td>
<td>11.32</td>
<td>43.4</td>
</tr>
<tr>
<td>the level of education motivation</td>
<td>12.53</td>
<td>28.3</td>
</tr>
<tr>
<td>formation of value orientations</td>
<td>14.15</td>
<td>65.01</td>
</tr>
<tr>
<td>Together:</td>
<td>12.67</td>
<td>45.57</td>
</tr>
</tbody>
</table>

The results of the diagnosis of the formation of the competitiveness of future IT specialists in terms of cognitive criterion after completion of the formative experiment

<table>
<thead>
<tr>
<th>Indexes</th>
<th>%, at the ascertainment stage</th>
<th>%, at the formative stage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>KG</td>
<td>EG</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>A</td>
</tr>
<tr>
<td>Possession of professional knowledge</td>
<td>13.21</td>
<td>38.68</td>
</tr>
<tr>
<td>Possession of professional skills and abilities</td>
<td>38.68</td>
<td>37.74</td>
</tr>
<tr>
<td>Together</td>
<td>25.94</td>
<td>38.21</td>
</tr>
</tbody>
</table>
The results of diagnostics of the formation of competitiveness of future IT specialists according to the **personal-reflexive** criterion after completion of the formative experiment

<table>
<thead>
<tr>
<th>Indexes</th>
<th>%, at the ascertainment stage</th>
<th>%, at the formative stage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>KG</td>
<td>EG</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>A</td>
</tr>
<tr>
<td>The level of formation of personal qualities</td>
<td>11.32</td>
<td>44.34</td>
</tr>
<tr>
<td>Reflection of activity</td>
<td>14.15</td>
<td>37.74</td>
</tr>
<tr>
<td>Together</td>
<td>12.74</td>
<td>41.04</td>
</tr>
</tbody>
</table>

The results of the diagnosis of the formation of the competitiveness of future IT specialists according to the **professional activity** criterion after the completion of the formative experiment

<table>
<thead>
<tr>
<th>Indexes</th>
<th>%, at the ascertainment stage</th>
<th>%, at the formative stage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>KG</td>
<td>EG</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>A</td>
</tr>
<tr>
<td>The level of development of the creative potential of the individual</td>
<td>10.38</td>
<td>23.58</td>
</tr>
<tr>
<td>The level of development of technical thinking</td>
<td>8.49</td>
<td>19.81</td>
</tr>
<tr>
<td>Professional mobility and flexibility</td>
<td>9.43</td>
<td>20.75</td>
</tr>
<tr>
<td>Ability to work in a team</td>
<td>16.04</td>
<td>26.42</td>
</tr>
<tr>
<td>The level of development of communication skills</td>
<td>13.21</td>
<td>23.58</td>
</tr>
<tr>
<td>The level of development of organizational skills</td>
<td>14.15</td>
<td>29.25</td>
</tr>
<tr>
<td>Critical thinking</td>
<td>10.38</td>
<td>24.53</td>
</tr>
<tr>
<td>Together</td>
<td>11.73</td>
<td>24.0</td>
</tr>
</tbody>
</table>
### Table 3.5

<table>
<thead>
<tr>
<th>Criteria</th>
<th>%, on the affirmative stage</th>
<th>%, on the formative stage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>KG H A L</td>
<td>KG H A L</td>
</tr>
<tr>
<td>motivational and valuable</td>
<td>12.67 45.57 41.76</td>
<td>19.18 50.62 30.19</td>
</tr>
<tr>
<td>cognitive</td>
<td>25.94 38.21 35.85</td>
<td>32.1 42.92 25.0</td>
</tr>
<tr>
<td>professional activity</td>
<td>11.73 24.0 64.3</td>
<td>18.6 38.95 42.46</td>
</tr>
<tr>
<td>personally reflective</td>
<td>12.74 41.04 46.23</td>
<td>21.7 52.36 25.94</td>
</tr>
<tr>
<td>Together</td>
<td>15.77 37.2 47.0</td>
<td>22.9 46.0 30.9</td>
</tr>
</tbody>
</table>

The results of the diagnosis of the formation of the competitiveness of future specialists in information technologies according to the specified criteria after the completion of the formative experiment.
3.3. CONCLUSIONS

An automated system for diagnosing the competitiveness of future information technology specialists can be recommended for the work of structural divisions of the psychological and educational direction in institutions of professional pre-higher and higher education to determine the level of formation of key personal qualities of education seekers.

3.4. REFERENCES


