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MANAGEMENT OF PROFESSIONALLY-ORIENTED STUDIES OF INFORMATIVE SUBJECTS FUTURE TEACHERS OF TECHNOLOGY

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ABSTRACT

The article deals with the problem of management of professionally-oriented teaching of Information technology disciplines of future technology teachers. The criteria for the formation of information competence of future technology teachers are identified. Levels of formation of information competence of future technology teachers are characterized: high, medium and low. The methodology of professionally-oriented teaching of Information technology disciplines of future technology teachers is grounded, which includes: content design, integration of traditional and innovative organizational forms and methods, application of active and interactive teaching technologies; their functions, tasks, a set of necessary and sufficient, special professional knowledge and skills that are formed in logically-based process of studying Information technology disciplines. Research-experimental work on the determination of the effectiveness of the method of professionally-oriented teaching information disciplines to future technology teachers was conducted. Quantitative and qualitative analysis of the experimental work to confirm effectiveness of the methodology of professionally-oriented teaching information disciplines to future technology teachers was investigated. The results of the experiment revealed positive dynamics of formation of information competence of future technology teachers (in the experimental groups a high level of formation of information competence increased compared to the establishing stage by 23.85%; medium – by 11.95%, and low one decreased by 35.8%. In the control groups dynamics is insignificant).

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Introduction.

The modern period of development of society is characterized by the process of informatization, which is ensured by the use of information as a product, which includes intensification of all spheres of human life and society. One of the tasks of informatization of society is informatization of education, which is based on the use of new information and communication technologies, with the purpose of professionally-oriented training and improving the quality of preparation of the younger generation for a comfortable (both psychologically and in practical terms) life.

Analysis of scientific works.

The importance of informatization of education is reflected in a number of state and normative documents, namely: Laws of Ukraine "On Education" (2017), "On Higher Education" (2014), Resolution "On holding parliamentary hearings on the development of information society in Ukraine (2005)", National Strategy for the Development of Education for the period up to 2021 (2013), which emphasizes the need to update the content, forms and methods of training teaching staff on the basis of advanced concepts and introduce new technologies.

The disclosure of various aspects of teacher training in the conditions of informatization of education, psychological and pedagogical principles of the implementation of training using modern information technologies was carried out in the papers of scientists (S. Abdullaev [1], O. Avramenko [2], V. Bykov [4], Ya. Bobyleva [6], V. Bubnov [7], I. Voitovych [8], R. Hurevych [10], A. Hurzhii [11], M. Zhaldak [13], A. Kasperskyi [17], L. Makarenko [20], L. Maslennikova [21], N. Morze [22], S. Semerikov [25], O. Spirin [27], S. Yashanov [29] and others).

Some aspects of professional and personally-oriented vocational training and training of future teachers are considered by O. Blahomyslov [5], I. Zhernoklieiev [14], M. Korets [18], V. Kurok[19], and others.

However, scientific researches lack targeted developments in the management of professionally-oriented learning of information technology disciplines of future technology teachers.

The experience of higher pedagogical education convincingly confirms the statement that it is necessary to take into account the internal contradiction of the requirements that must be met by all the links of the pedagogical system for the effective solution of the problem of professionally-oriented teaching of information technology disciplines to future technology teachers. Successful solution of this problem is possible due to the introduction of modern content and innovative learning technologies that have significant opportunities for individualization and differentiation of training, computer visualization of educational material, effective feedback, positive motivation and interest in learning and developing the informative competence of the future teacher.

The results of the analysis of information competence in psychological and pedagogical literature (N. Balovsiak [3], M. Holovan [9], L. Kalashnikova [15], S. Rakov [24], Ye. Smyrnova-Trybulska [26], V. Evdokymova [28]) indicate that this is an integrative entity that contains a number of components that determine its structural specificity and multidimensionality.

The structure of information competence of a person characterizes his knowledge, skills, aspirations, motives, interests, ability and readiness to use ICT in professional activity.

Research methodology.

Research-experimental work on the research problem was conducted in three stages: diagnostic (ascertaining experiment), final (control experiment).

At diagnostic stage, an analysis of existing educational programs practical: teaching experiment for the training of technology teachers was carried out; analysis of the status of the training future technology teachers in the context of the use of information technology disciplines tools; studying and generalizing the experience of technology teachers in institutions of secondary education on the use of information technologies in the educational process; search and selection of software for professionally-oriented training of students and schoolchildren of educational branch "Technology"; interviewing and questioning teachers who have and do not have the experience of using information technologies in the educational process. According to the results of ascertaining experiment, the method of professionally-oriented training of information technology disciplines of future technology teachers is developed: 1) analysis of the content, selection and structuring of learning material for the training of future teachers, 2) combination of innovative methods and organizational forms of future technology teachers training,

3) use of innovative teaching technologies in the system of professional training of future technology teachers in the process of studying information technology disciplines.

Practical stage (teaching experiment) envisaged an experimental verification of the effectiveness of the developed methodology of professionally-oriented training of information technology disciplines of future technology teachers.

The final stage of the experiment included the identification of indicators of the effectiveness of the methodology, generalization of practical and theoretical experience in the process of analysis of the obtained data of research-experimental work, the formulation of general conclusions, the development of methodological recommendations for students and teachers; the final evaluation of the results of research-experimental work as a whole.

The study covered 285 students of the experimental group and 270 students of the control group of the specialty "Technological Education", 555 students and 69 teachers total.

Methods of research.

According to the purpose of the experiment, namely, the determination of the level of formation of information competence of future technology teachers, the following diagnostic methods were used: 1) theoretical analysis of the problem (analysis of the products of activity regulating the educational process of the specialty "Technological Education"; 2) pedagogical observation on the course of educational process of students - future technologists; 3) comparative analysis of the experience of organizing the professional training of students of the specialty "Technological Education"; 4) an expert assessment for the development of the model and justification of the method of professionally-oriented training of information technology disciplines of future technology teachers as an indicator of formation of informative competence; 5) systematic analysis of philosophical, psychological and pedagogical, educational and methodical literature on professionally-oriented education; historical and system analysis of theoretical foundations of the research problem; 6) interviews, polls, questionnaires, testing, studying documentation to determine the state of information competence of future technology teacher, identifying the factors that influence its formation in the process of training and study of information technology disciplines; 7) methods of mathematical analysis of the data.

Discussion.

The analysis of scientific sources (B. Dodonov [122], M. Zhaldak [13]; S. Karakozov [16], N. Nasirova [23], M. Yashanov [29]) showed that researchers mark cognitive ("content", "cognitive-content", "knowledge"), activity ("skills", "result of manifestation", "technological"), motivational ("motivational-axiological", "axiological-semantic") and reflexive ("emotional-vocational", "self-improvement", "of personal growth") criteria in the structure of information competence.

We shall mark the main criteria of information competence of future technology teachers: motivational, cognitive, activity and personal-reflexive.

Motivational criterion characterizes the attitude of future technology teachers to information activities, expressed in targeted facilities; the desire and ability (readiness) to acquire knowledge, skills and abilities in the field of computer science, computer technology and information and communication technologies; the need to create information products; the desire for creative information processing and the creation of information models using ICT; interest in information activities; cognitive, professional and creative motives that influence goal-setting in the process of information activity, the desire to independently use capabilities of the computer as a means of information activity of future technology teachers; orientation towards the achievement of a high level of informational competence.

Cognitive criterion is characterized by the presence of theoretical, practical and technological knowledge in computer science and ICT; knowledge of information technologies; the ability to analyze information resources and identify their capabilities for solving the tasks of future professional activities.

Activity criterion is characterized by the experience of cognitive activity, recorded in the form of its results – knowledge in the field of information technology disciplines; experience in using and processing information; abilities to: work with specific software at the level of a skilled user as a future technology teacher; navigate information environment to find information for solving simple tasks.

Personal-reflexive criterion reflects the ability of a specialist to adequately assess his own achievements in information technology disciplines; his level of information competence; the desire for self-actualization, self-development, constant work on oneself in the field of information technologies,

self-analysis and self-assessment of professional activity on the basis of information technologies; a set of personally significant and valuable aspirations, ideals, beliefs, views, attitudes to the product and subject of activity in the field of technology and information processes.

The degree of expression of criteria indicators of information competence makes it possible to identify and characterize levels of their formation: low, medium and high. Their characteristics are given in Table 1.

Table 1. Criteria, indicators and levels of formation of information competence of the future technology teacher

Criteria	Indicators		
	High	Medium	Low
Motivational	Independently Demonstrates constant enduring interest in various sources of information, information technologies. Motivates his position by the importance of personal, social and professional information capacity building information for professional activity.	Shows interest in Various sources of information, information technologies situationally. Motivates his position by personal attitude towards the teacher or source of information, information technology.	Shows limited interest in certain sources of information, information technology. Motivates his position by personal attitude towards the teacher, or sources information, information technology.
Cognitive	Stable understanding of the place and role of information competence as a system of personal, social and professional knowledge about information environment, sources of information, information technology.	Unstable understanding of the place and role of information competence as unsystematic personal, social and professional knowledge about information environment, sources of information, information technology.	Fragmentary information about the place and role of information competence as disconnected personal, social and professional knowledge about the information environment, sources of information, information technologies.
Activity	Persistently masters information technologies in Educational and extracurricular time, which systemically enrich personal, social and professional building of a person and raise his information competence.	Unstably masters aggregate information technologies in study and extra-curricular time, which has a non-systematic effect on the enrichment of personal, social professional formation of a person and building his information competence.	Fragmentarily masters individual information technologies that affect the enrichment of individual personal, social and professional qualities and raise information competence of a future technology teacher specifically.
Personal-reflexive	Is characterized by constant manifestation of professional reflexivity and self-criticism, ability to carry out an adequate self-assessment of achievements in the field of ICT (own possibilities in using information technologies, information resources, confidence in their choice and implementation); orientation for further self-development.	Reflexivity and self-criticism is revealed in a significant degree, sufficient level of ability to carry out an adequate self-assessment of achievements in the field of ICT and self-organization of personal activity, unstable orientation to further self-development.	Reflection and self-criticism are practically absent, episodic ability to make an adequate self-assessment of achievements in the field of ICT; insufficient self-organization of personal activity, almost no orientation to further self-development

Levels of formation of information competence of a future technology teacher were evaluated on a 5-point scale. The following indicators were used for estimation:

Student gets “1” point, if he demonstrates the lack of information technology knowledge and skills; does not understand the principle of the operation and use of the simplest teaching aids; performs

actions based on intuition, by trial and error; cannot understand the task performed with the use of conventional symbols; experiences difficulties in performing tasks of the 1st level of complexity.

Student gets "2" points if he demonstrates weakness in computer knowledge; reveals knowledge of only a few concepts of conventional symbols; makes decisions at the empirical level; partly explains the principle of the use of the simplest teaching aids; copes with the tasks of the first level of complexity partly.

Student gets "3" points if he demonstrates satisfactory theoretical knowledge; knows and understands the principle of operation and application of the simplest teaching aids; understands the basic elements of technology language; is able to solve typical problems of the first and second level of complexity; is able to apply knowledge in a particular situation.

Student gets "4" points if he demonstrates quite complete knowledge and skills; is able to apply knowledge in a new situation; carries out mental operations at the level of analysis and synthesis; successfully copes with tasks of the second level of complexity; manages to solve elements of tasks of the third level of difficulty.

Future technology teachers get "5" points if they perform both theoretical and experimental tasks of all three levels of complexity.

The formation of indicators of each criterion is consistent with the percentages: high level corresponds to 75-100% (3,8-5,0 points), medium - 45-74% (2,4-3,7 points), low - 30-44% (1.3-2.3 points).

Therefore, the marked criteria (motivational (M), cognitive (C), activity (A) and personality-reflexive (PR)), indicators and levels (low, medium, high), the formation of informational competence of future technology teachers will allow to establish objective effectiveness of the outlined study.

Research results.

For the diagnosis of the state of the formation of information competence on the basis of *motivational criterion* it is necessary to study external and internal motives of student learning as one of the aspects of successful future professional activity, since the peculiarities of the dynamics of motivation depends, in general, on the attitude to training, and later – to professional activities. Therefore, it is necessary to study professional orientation, motivation and self-determination of a young person, his preparation and activity at all levels: family, friends, system of vocational education, which will improve the process of preparation of future teacher in a concerted effort.

To diagnose the presence of certain motives to studying information technology disciplines in motivational complex of students, as well as their professional orientation, a modified questionnaire "Motivation to study" by T. Ilina was used, in which there are three scales of assessment: "Acquisition of knowledge" (desire for knowledge, curiosity); "Mastering a profession" (desire to master professional knowledge and to form professionally important qualities); "Obtaining a diploma" (desire to acquire a diploma with formal acquisition of knowledge, desire to find a way round when passing examinations and credits).

The generalized level of formation of information competence of future technology teachers according to motivational criterion in EG is (in points) H_e^0=2,31; KG – $H_к^0$= 2,33. The difference between them is 0.02%, which does not affect the effectiveness of the data.

To determine the level of formation of information competence of future technology teachers according *to cognitive criterion*, test tasks for assessing knowledge, a questionnaire for identifying interest in the study of information technology disciplines, the desire and readiness to use acquired knowledge in future professional activities and for self-development are used. The emphasis is on the study of information technology disciplines for raising the level of professional teacher training technology, as well as relation of professionally-oriented learning with fundamental concepts of information technology. For diagnostics, issues related to the professionally oriented training of future technology teachers with in-depth study of computer science disciplines have also been developed. This approach allowed the transition from the orientation of the course material to only one specialization, to a more professionally oriented methodology. For diagnostic purposes, questions related to professionally-oriented training of future technology teachers with in-depth study of information technology disciplines have also been developed. This approach allowed the transition from orientation of the course material to only one specialization, to a more professionally-oriented methodology.

At the stage of ascertaining experiment, students' high need for information about innovative activity of future technology teacher in the field of using information technologies and low level of personal motivation was revealed.

The generalized level of formation of information competence according to cognitive criterion of students in EG is (in points) H_e^0=2,39; KG – $H_к^0$= 2,38. The difference between them is 0.01%, which does not affect the performance of the data.

The level of formation of information competence according to *activity criterion*, in particular, the ability of students to solve professional tasks using the means of new information technologies was studied by analyzing practical work and was determined by the following indicators: the quality of tasks performance, the manifestation of independence while performing tasks.

Diagnosis on determining the initial level of formation of information competence according to activity criterion showed that in EG it is (in points) H_e^0=2,33; KG – $H_к^0$= 2,29. The difference between them is 0.8%, which does not affect the performance of the data.

Analysis of formation of indicators of cognitive and activity criterion of information competence of the respondents makes it possible to conclude that they have a low level of formation of knowledge and skills to carry out professional activities on the basis of a competent approach. The lack of a system of disciplines and a professionally-oriented approach in the teaching of information technology disciplines is the reason for generally low level of formation of indicators of cognitive criterion of information competence of future technology teachers.

To assess formation of information competence of future technology teachers according to *personal-reflexive* criterion, the questionnaire of personal orientations by E. Shostrom (SAT), which is based on the ideas of self-actualization of A. Maslow and other theorists of the existential-humanistic direction in psychology, which allows to register two basic and ten additional parameters of self-actualization was used.

At the stage of ascertaining experiment, students' inner attitude to innovation and psychological readiness to use ICT in educational process were clarified. For example, if a student says that a computer program can be used as a demonstration guide at technology lessons, but it is very difficult to implement, it proves that the student is aware of the possibilities of introducing innovation, but finds it difficult and, most likely (without additional educational work), will not use information technologies in future professional activities.

Diagnostics conducted on determination of the initial level of formation of information competence according to personal-reflexive criterion of students in EG is (in points): H_e^0=2,27; KG – $H_к^0$= 2,33. The difference between them is 1.2%, which does not affect the performance of the data.

The research conducted on determination of levels of formation of information competence of future technology teachers has allowed to summarize the obtained data, which is reflected in table 2.

Table 2. Generalized indicators of the initial level of formation of information competence of future technology teachers (ascertaining experiment)

Groups	Criteria							
	C		M		A		PR	
	points	%	points	%	points	%	points	%
EG	2,39	47,8	2,31	46,2	2,33	46,6	2,27	45,4
KG	2,38	47,6	2,33	46,6	2,29	45,8	2,33	46,6

Analysis of the data in the table showed that the average arithmetic mean C_e of formation of information competence in EG is 2.39 points, which is 47.8%, M_e is 2.31 (46.2%), A - 2.33 (46.6%), PR – 2.27 (45.4%), in KG: C_c - 2.38 (47.6%), M_c - 2.33 (46.6%), A_c - 2.29 (45.8%), PR_c - 2.33 (46.6%). The obtained data testify that formation of information technology competence according to cognitive criterion in EG is 47.8%, KG - 46.7%, which corresponds to low level. Formation of information technology competence on the basis of motivational criterion in EG is 46.2%, KG - 46.6%. These are low-level indicators. The indicators of activity criterion of formation of information competence are low: in KG it is 46.6%, KG – 45.8%. Formation of information competence according to personal-reflexive criterion is low: in EG it is 45.4%, KG - 46.6%.

There are slight differences in the formation of EG students' and KG students' information competence. However, even such difference requires validation. To do this, we apply the Pearson

criterion, whose calculation showed that according to cognitive criterion it is 1.12, motivational - 0.8, activity - 5.7, personal-reflexive - 8.5. The obtained data prove that the results of formation of information competence in the process of ascertaining stage of the experiment were almost not influenced by any factors.

The results of the study are graphically shown in Fig. 1

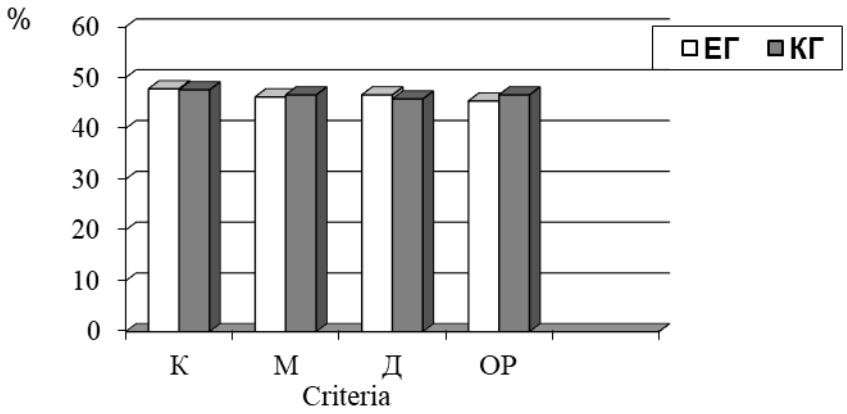

Fig. 1. Initial levels of formation of information competence according to the criteria: C - cognitive, M - motivational, A - activity, PR – personal-reflexive

The figure graphically demonstrates low level of formation of information competence according to cognitive, motivational, activity, personal-reflexive criteria in experimental and control groups, and a slight numeral difference between them. The difference in EG between cognitive and motivational criteria is 1,6%, activity - 1,2%, personal-reflexive - 2,4%; in KG, respectively, 1.0%, 1.8% and 1.0%. This means that there is almost no difference between the levels of formation of information competence for cognitive, motivational, activity, personal-reflexive criteria.

According to the results of ascertaining stage of the experiment, indicators of the initial level of formation of information competence were summarized and their distribution by levels as shown in Table 3 was carried out.

Table 3. Initial level of formation of information competence of future technology teachers (ascertaining experiment)

Levels	Experimental group	Control group	Difference, %
High	3 (1,05 %)	4 (1,48 %)	0,43
Medium	113 (39,65 %)	99 (36,67 %)	2,98
Low	169 (59,3 %)	167 (61,85 %)	2,55

Ascertaining stage of the experiment showed that the students have a low level of formation of information competence according to cognitive, motivational, activity, personal-reflexive criteria, both in experimental and control groups.

The following conclusions can be drawn from the analysis of the materials of ascertaining stage of the experiment.

Most future technology teachers have significant imperfections in the formation of knowledge, abilities and skills, which is due to the traditional approach to the study of information technology disciplines.

Consequently, studying and analyzing the state of formation of information competence of future technology teachers at the stage of ascertaining stage of the experiment made it possible to find out general tendencies and differences in the peculiarities of student' training in higher educational institutions of Ukraine, which train teachers in the specialty "Technological Education".

During the organization of educational experiment, the current state of training of specialists was taken into account, when the attention of the subjects of educational process is drawn to the intensive process of self-development of educational system, growth of its internal capacity and the expansion of

educational services sector in this regard. On the one hand, professionally-oriented training is considered as a further movement of ideas and experience of professional training, on the other - as the formation of a qualitatively new social system, democratic and humanistic in essence.

Taking into account the above, there was a need to approbate the developed method of professionally-oriented training of information technology disciplines to future technology teachers. Further work was directly carried out within the framework of the designed content of information technology disciplines and their development through the integration of traditional innovative forms, methods and technologies. Experimental research was carried out with the observance of a number of requirements: the experiment, the ratio of the amount of tasks to the time allocated to the curriculum to study these disciplines, a reasonable choice of experimental bases for internship.

In experimental groups in the process of ascertaining stage of the experiment, methods of professionally-oriented training of information technology disciplines of future technology teachers were implemented, in the control groups educational process was carried out according to the traditional method. Implementation of the method of professionally-oriented training of information technology disciplines of future technology teachers was carried out in stages within their own activities (class, extra-curriculum, research, in the course of pedagogical practice).

Methodical work at each of these stages of experimental work was aimed at forming cognitive, motivational, activity, personal-reflexive criteria of information competence of future technology teachers. The objectives and tasks were determined for each of the stages, forms and methods, educational implementation technologies, forms of control and result were chosen.

Provision of professionally-oriented training for future technology teachers took place in the direction of pedagogical management at the first stage, due to partial transfer of functions from the teacher to students at the second stage, to self-management by future teachers of self-development of their information competence with corrective and supporting role of the teacher at the third stage.

To avoid artificiality in the description of the experiment, we shall consider the content of the staged implementation of the method of professionally-oriented training of future technology teachers during the organization of classes, self-organization of students and their pedagogical practice.

At the first stage of educational experiment, the purpose of the method's implementation was to determine formation of cognitive and motivational criteria of information competence.

At the second stage of educational experiment, formation of activity criterion and development of personal-reflexive criterion of information competence of future technology teachers was chosen as a priority trend. At this stage, the following tasks were solved: systematization of the knowledge obtained at the previous stage and stimulation of students to their implementation in practical activity; acquiring the skills necessary for carrying out vocational and pedagogical activities; formation of students' critical thinking skills; development of intellectual, communicative, empathic, reflexive abilities of future technology teachers; formation of a personal need for the promotion of technical and technological values within the framework of pedagogical practice. The implementation of the teaching methodology included the use of the following methods: interactive (pair work, work in small groups, problem analysis, discussion, round table, role and business game, training), historical (multi-perspective, analysis of historical sources, empathy), problem-searching (solving pedagogical situations, research), reflexive (introspection, self-knowledge). To provide professionally-oriented training, the following forms of organization were chosen: lecture, lecture of the review of problem definition and analysis of ways of its solution, seminar-discussion, students' conference, training, educational practice; educational technologies: development of critical thinking; training in collaboration and facilities: textbooks and manuals, curricula for technical and technological disciplines, text and visual sources.

At the third stage of educational experiment, formation of future technology teachers' own professional experience was ensured.

The tasks that were solved at this stage include: raising the level of practical readiness of students for future pedagogical activities; development of skills to use interdisciplinary connections in educational process of the school; carrying out diagnostics and self-diagnostics of the level of formation of information competence; search of effective ways of individual correction of levels of formation of information competence of future technology teachers; professional, social, national and cultural self-identification of the student's personality. Methods of training at this stage were the following: interactive, reflexive (self-knowledge, self-analysis, self-diagnosis), projective; forms of organization: constituent conference, final conference, seminars-trainings (for the development of reflexive behavior),

consultations, work teaching practice, associations of methodologists (on specialty, on pedagogy, on psychology); educational technologies: creative design technologies.

All educational materials on information technology disciplines (curriculum on various topics, multimedia lectures, training databases and other teaching materials) were placed on a server to which students had free access both during classes and in their free time. It allowed the students to independently master the educational material, to find out incomprehensible questions for them, to consolidate the skills acquired in the computer network acquired in practical classes.

The methodology of work in the process of forming cognitive criterion of information competence in the classes of the first stage varied for students of different groups: for representatives of groups of low and medium levels of training, a specially designed introductory course of lectures, the specifics of which was the use of multimedia presentations, video films, electronic screen, local computer network was conducted. Consolidation of theoretical knowledge took place in practical classes using instruction cards, which determine the sequence of tasks of low and average levels of complexity, methodological instructions on the task execution. The choice of difficulty levels allowed to reveal self-assessing settings of students of experimental group, which changed during the whole stage with a tendency from overestimation to adequate (in control group written answers to the question "How do you assess your achievements in information technology?" did not allow to talk about the tendencies of changes in self-esteem). For high-level students, creative tasks that consisted of developing crossword puzzles that included the basic notions of discipline at this stage: informatics, information, information technology, computer networks, safety rules, rules of activity in a local network, and others were given; illustration of multimedia lectures, creating presentations; independent study of new features of the computer network. Students of all levels prepared abstracts on subjects of discipline, which contributed to the awareness of the importance of information technology in professional activities.

Discussions were organized on the topics: "Possibilities of using information technologies in the professional activity of future technology teacher", "Principles of effective communication in computer network", etc. As a result of this work, the teacher diagnosed personal significance for students of the studied elements of content by the method of incomplete sentence test. In experimental group, this technique recorded a great interest in learning and understanding learning material in comparison with control group (in control group, students completed sentences not with individual statements, but with cliches). In addition, as the specific means of training in experimental group, thematic presentations, created by students of high level of cognitive criterion and an electronic screen were used, which allowed to actualize personal attitude towards them by practically all students (estimation replicas-judgments were recorded).

The contents of the second stage included, for example, the following sections of discipline "Information Technology": 1) automated processing of information: basic concepts and technologies; 2) general structure and structure of personal and computer systems, their software; 3) organization of placement, processing, searching, storage and transmission of information; 4) protection of information from unauthorized access, anti-virus protection of information; 5) local and global computer networks, network technologies of information processing; 6) application software; 7) automated systems: concept, composition, types, as well as teaching and research work of students of high level of cognitive criterion of information competence over non-auditing projects (for example, joint development of multimedia program "Training on safety of work on PC", etc.). The content of training experimental group includes the notion of "computer crime", "authorized information", "copyright for Internet information", knowledge and observance of rights and obligations of network users.

The rules of the training situation at this stage envisaged independent development and further discussion of the rules of group interaction in the network (for example, ban on transferring a message received from network partner to other users, transferring offensive information on network, etc.) by the students with the teacher. The teacher gave verbal and written network messages as an example of dialogue and correct communication. While in control group at moments of free communication in the network there were unethical statements and imposition of unwanted partner of the network contact, in experimental group, similar manifestations were practically absent.

Achievement of the goals of the stage in experimental group was diagnosed through the analysis of mini-compositions that demonstrate the mastery of the concepts of computer networks at the level of meaning (authenticity and corruption of information, methods of information security, electronic signature, legal and social norms of activity, etc.), qualitative assessment the results of solving creative tasks of navigation and finding information in the network, student monitoring in the process of group

ethical discussions and dialogues, analysis of the list and content of network contacts. In control group, the concepts discussed were mainly learned at the level of reproduction or understanding (for example, “any information needs password protection”), while students in the experimental group have mastered the concept at the level of application and personal interpretation (for example, “electronic signature can and must be used for payments via the Internet”, “authorized information is information on which the individual is, the author with his views on the problem”).

For the diagnosis of the state of formation of motivational criterion, the same methods as those used during ascertaining experiment were used.

In order to determine the students’ attitude to special disciplines, the question is asked: “What is the importance of studying information technology disciplines for the development of professional (information as a component) competence of a future teacher and what motives are essential for their development?”. Based on the data obtained, it can be concluded that the future teacher’s mastering information technology disciplines and motives, which provide it, takes place much faster for the students of EG, first of all, from socially and emotionally conscious professional positions. Obviously, such high rates EG students are related to the correct assessment of the potential of information technology disciplines and their teaching methods by students.

Diagnostics of motivational component of information competence contained the following list of statements: there is a desire to engage in pedagogical work on the condition of informatization of education, I see the need for constant improvement of pedagogical activity, my own intellectual development, I am interested in new achievements in the field of computer technologies and wish to introduce them in educational process, interested in the profession of technology teachers, Design and Technology, there is a desire and ability to show creativity in the decision of professional tasks; there is orientation on achieving high results.

Methodology of work in experimental group was based on the use of gaming technology. During the simulation role-playing game “Designing a local sewing network” work was carried out by small groups, participants of the game were offered tasks of various levels of complexity. Students of middle and low levels worked in local network, choosing partners “manufacturers” of computer technology and discussing with them possible variants of equipping “the enterprise” with the equipment of local network.

High-level students acted as expert-consultants who evaluate the feasibility of acquiring one or another local network configuration and, if necessary, recommend its most optimal structure. Based on evaluative judgments of expert participants, the culture of communication, creative activity during the discussion and the choice of network structure, and the confidence of navigation in the network were recorded. Communicative situation codes were also significant: nature and content of network interactive messages of the participants in the process of “chats” (group discussions of the composition and cost of the local network, which is designed for “production”) and non-verbal emotional means ("smileys").

“Manufacturer” received an order: “customer” wanted to buy fabrics for his organization, but did not know exactly how much he would need, which conjuncture, what length of the fabric, what color to choose, etc. “Customer” sent “manufacturer” catalog of fabrics, their availability and color with the help of local network.

The rules of the game were as follows: if the “manufacturer” believed that “the customer” chooses fabrics that are not suitable for him, he had to convincingly prove it and equally reasonably prove to “the customer” what fabrics he needed. Next, “the manufacturer” discussed with “the customer" the cost of fabrics according to the price list received from the site of the same company, resulting in a joint decision on the subject of the most effective cooperation. If “the customer” was not fully satisfied with the offer of “the manufacturer”, then he had the right to contact another firm, as long as his requirements were not completely satisfied. Then “the seller” of the company signed an account for the purchase of fabrics, which were analyzed by “expert” (a student of a high-level group) regarding practicability of buying exactly this fabric.

After the game, the total points scored by the students for the entire game were calculated, and, according to a certain amount of points (set by the teacher), each player received a corresponding mark.

As a result of conducting a business game students found the meaning of using computer networks in future professional activities. Students’ systemic thinking was intensified by discussions on the topics “What structure of the local network is more reliable?”, “What do you think should information structure of an educational institution be like?” and so on. In addition, at this stage, research work of middle and high level students was envisaged, which involves the use of computer networks

for searching and comparative analysis of information, which greatly contributed to argumentation in discussions, assessment of the quality of computer information, search for personal meaning of network activity. In the course of observations over the course of discussions, the solution of various levels of navigation and search information in the network, the participation of students in business game, it was noted that some of the students in low-level group recorded an increase in the level of motivation criterion of information competence.

Thus, level of formation of motivational criterion for students in EG is (in points H_e^0=3,85; KG – $H_к^0$= 3,07. The difference between them was 15.6%, which at the stage of educational experiment affects the formation of motivational criterion.

Obtained results are shown in Fig. 2

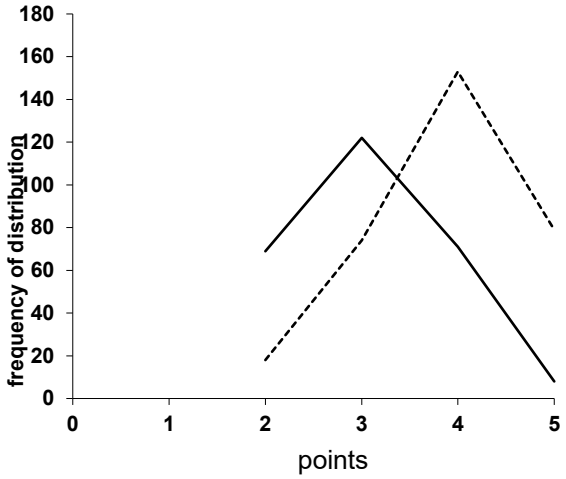

Fig. 2. Distribution of points according to the level of formation of students' motivational criterion:
_____ control group
--------- experimental group

The analysis of Figure 2 graphically shows that there is a significant difference between the indicators of the students' motivational criterion in both groups.

The level of activity criterion formation, in particular students' ability to solve professional tasks in practice, was realized on the basis of: possibilities of professional disciplines in formation of information competence of future technology education teachers; ensuring interdisciplinary approach, forming subject-subject interaction in educational process; pedagogical correction and feedback in the process of development and self-development of students with the help of control and diagnostics, oriented on components, criteria and indicators of information competence; formation of own experience of professional and pedagogical activity on the principles of polytechnic.

The level of information competence formation according to cognitive criterion at the third stage was determined in the course of monitoring activities of future technology teachers in the course of work on common network projects (in particular, the creation of a training Web site, etc.). In this context, individual attitude to the problems of using network computer technologies in professional activities (the ethics of holding professional dialogue in the Internet, limits of possibilities and the range of the use of computer networks in professional activities, the responsibility of the member of Internet community for the consequences of their information activities) was analyzed.

The application of generalized indicators of the formation of cognitive criterion and the corresponding characteristics of groups allows to integrate disparate indicators and characteristics and to be guided by a holistic view on information competence of future technology teachers, since the criterion of sign (firmness of mastery, creativity, dialogue) is simultaneously system-forming elements of educational criterion.

Each answer is assigned a weight in points, which is determined by filling the base in the range from 0 to 100 points so that the total number of points of one question does not exceed 100. In addition, the level of complexity of the question is indicated. If the question has a second level of difficulty, then the weight of the answer when calculating the results automatically increases accordingly to coefficient

2. Thus, the number of maximum possible points in answering the first level of difficulty is 100, the second level - 200, the third level - 300 points.

To perform the task of the first level of complexity, passive knowledge about the processes occurring in the network computer environment (concepts, principles, etc.) is enough; for the second level, an understanding of the essence of the phenomena of network computer environment is needed; the third level involves the possibility of a creative approach to solving the problem. When calculating the results of network computer control of knowledge, it is taken into account that in order to get a positive mark, a student has to the tasks of both first and second level, and to get an excellent mark, a student has to do all the tasks of first and second level and more than half the task of the third level.

All answers are divided into correct and incorrect. Incorrect answers are rated 0 points. If the correct answer is only one, it is rated 100 points. If there are several correct answers – two or more, the weight can be divided by such algorithm: if it is enough to choose only one of the correct answers, each correct answer is evaluated 100 points; if several correct answers at the same time are implied, then it is necessary to divide 100 points between the number of correct answers in such a way so that they give 100 points in total. For example, three correct answers weighing 33, 33, and 34 points.

We shall consider an example of computer control of knowledge using check program Knowledge on the topic "Local and global computer networks". At the beginning of testing, a student is registered in the database, located on the server (registers himself in the file with the name of the group, chooses a topic). As an example of the use of differentiated tasks for identifying cognitive potential of future technology teachers, a question on the topic "Computer networks" can be given.

Questions of the first level of difficulty: What networks are called peer-to-peer?

- networks that have a dedicated server that combines peer-to-peer computers – 0б
- networks in which computers can be clients and servers for each other – 100,
- networks where only client computers are possible – 0.

Example of the second level of difficulty: What will an email address that includes the domain name of the server www, computer name (avp), suffix (ua) look like?

www/ua/avp – 0.

www.ua.avp – 0.

www.avp.ua – 100.

The third level of difficulty includes the following questions: What networks provide greater performance and data protection?

- peer networks – 0.
- network based on a dedicated server – 50.
- combined networks – 50.

In this case, in order to get the highest number of points, it is necessary to specify the second and third variants of answers.

The final score, got as a result of computer testing can be viewed on the server in the resulting file of the study group. The results of practical work, the study of the products of the students, selection of the task of a certain level of difficulty is fixed for further analysis and assessment of students' knowledge.

Consequently, generalized level of formation of cognitive criterion of students in Eg is (in points) H_e^0=3,94; KG – $H_к^0$= 3,2. The difference between them is 14.8%, which greatly affects the effectiveness of the data.

Obtained results are graphically shown in Fig. 3

The analysis of Figure 3 clearly demonstrates significant difference between the indicators of formation of cognitive criteria for students in EG and KG groups.

To diagnose acquired skills in network computer environment, a system of practical tasks of navigation in the network of three levels of complexity was developed on the topics being studied. Problems of low complexity contained detailed instructions for the student. Tasks of the middle level of complexity were formulated more abstract, they assumed the execution of tasks in different ways. Tasks of high level of complexity supposed to reveal the most optimal way of their execution.

In addition, for students who have successfully coped with the task of high level of complexity, there were additional tasks that develop reflexive, creative and dialogic personal qualities.

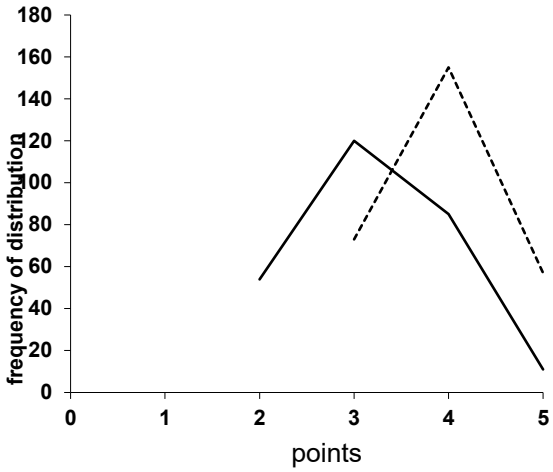

Fig. 3. Distribution of points according to the level of formation of cognitive criteria of students.

For example, they were asked to independently perform a comparative analysis of other network software products (in particular, search engines). Almost all students of high level of information competence were members of a computer club. This is explained by the fact that the club created conditions for satisfying cognitive interests in the field of network search and communication, finding the most significant partners in communication.

Consequently, the tasks performed to determine the initial level of formation of activity criterion for students in EG are (in points): H_e^0=3,92; KG – $H_к^0$= 3,2. The difference between them is 14.4%, which significantly affects the effectiveness of the data.

Obtained results are graphically shown in Fig. 4

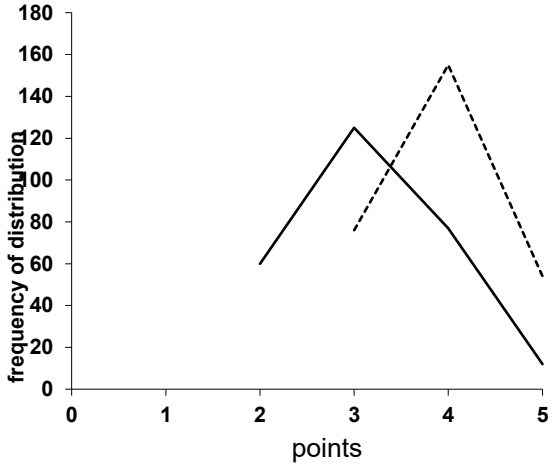

Fig. 4. Distribution of points according to the level of formation of students' activity criterion.

The analysis of Figure 4 clearly shows that there is a significant difference between the indicators of activity criterion of students in both groups.

In order to evaluate personal-reflexive criterion of future technology teachers, at the first stage, the subject of project tasks was used. In the process of project implementation, students acquired the skills of cooperation both within the student's academic group and beyond.

Defense of student projects took place at seminars. The most successful in the process of forming information competence were information technology projects. No less interesting and valuable were search-and-research projects. Successful fulfillment of the project tasks by students contributed to the development of creative, analytical, communicative, reflexive qualities, actualized spiritual, national, social, professional self-identification of future specialist in educational branch of "Technology".

The application of project technology in the framework of experimental research was a comprehensive means of teaching students, which intensified the formation of cognitive, motivational-axiological, activity and personal-reflexive components of information competence of future technology teachers.

At the second stage, solving educational and network tasks was carried out. Psychological test allowed to reveal levels of reflection, self-esteem. Students, who are not ready to jointly solve educational network tasks (tasks whose solution is impossible without the use of a computer network), who are passive when working with a computer, who are having difficulty finding a remote partner and conducting a professional and personal dialogue were identified in the reflexive sphere to low level of formation of information competence. Students who have the ability to share information, communicate with a remote partner, and implement business communication in a networked computer environment were included in middle level. Students who identify conscious motivation and dialogue in the implementation of joint networking activities were identified to high level.

The teacher's aim at the stage of self-presentation in network computer environment was to create conditions for students to acquire experience in the formation of individual position, creative expression of means of telecommunications and interaction with network partners. Leading indicators of formation of personal-reflexive criterion of information competence at this stage were creative and emotional-volitional.

At this stage in control and experimental groups, the students of middle and high levels were quantitatively prevailing. The rules of training situation at this stage implied the use of variables for communication and activities in network computer environment (for example, forums, chats, teleconferences, ICQ) by students. The possibility of operative network counseling at the request of students of experimental group using common, mutually comprehensible communicative codes, the emergence of organized and spontaneous problematic discussions (on computer aesthetics, types and methods of business communication in the network, etc.) were also envisaged.

On the basis of video diagnostics, the process of solving pedagogical problems using network computer environment with subsequent comments and evaluations, as well as fixing the results of student participation in network contests ("Golden Site", etc.), student conferences on the use of information technology in teaching and subject contests revealed that students of experimental group, in contrast to the students of control group, could freely express their thoughts and attitudes towards the researched phenomenon both in the usual verbal communication, and in network interaction.

Consequently, the tasks performed to determine the initial level of the formation of a personality-reflexive criterion for students in EG are (in points): H_e^0=3,68; KG– $H_к^0$= 2,97. The difference between them is 14.2%, which significantly affects the performance of the data.

Obtained results are graphically shown in Fig. 5

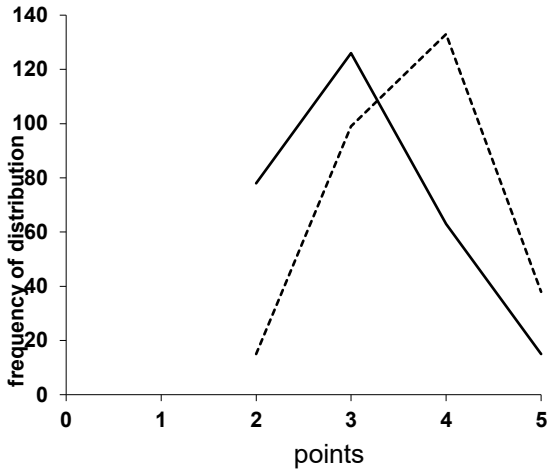

Fig. 5. Distribution of points according to the level of formation of students' personal-reflexive criterion.

Analysis of Figure 5 clearly demonstrates the difference between the indicators of formation of personal-reflexive criterion of students in both groups.

The results of the conducted research to determine the level of formation of the criteria of information competence of future technology teachers allowed to summarize the obtained data, which is reflected in Table 4.

The analysis of the data in the table shows that the average arithmetic mean $К_e$ of formation of information competence of future technology teachers in EG is 3.94 points, which is 78.8%, $М_e$– 3,85 (77,0%), $А_e$ – 3,92 (78,4%), PR_e – 3,68 (73,6%); y KG: $К_c$ – 3,2 (64,0%), $М_c$ – 3,07 (61,4%), $А_c$ – 3,2 (64,0%), PR_c – 2,97 (59,4%).

Table 4. The level of formation of information competence of future teachers of technology (shaping experiment)

Groups	Criterion							
	C		M		A		PR	
	points	%	points	%	points	%	points	%
EG	3,94	78,8	3,85	77,0	3,92	78,4	3,68	73,6
KG	3,2	64,0	3,07	61,4	3,2	64,0	2,97	59,4

The obtained data testify that cognitive criterion of formation of information competence of future technology teachers in EG is 78.8%, which corresponds to high level, KG - 64.0%, on average.

Motivational criterion for of formation of information competence of future technology teachers in EG is 77.0%, which corresponds to high level, KG - 61.4%. This is an average grade.

Activity criterion of formation of information competence of future technology teachers in EG is 78.4%, which corresponds to high level, KG - 64.0%. This is an average grade.

Personal-reflexive criterion of formation of information competence of future technology teachers in EG is 73.6%, which corresponds to high level, and KG - 59.4%. This is an average grade.

Comparative analysis of formation of information competence of future technology teachers according to the criteria revealed a significant difference between them.

To verify the validity of such difference, we shall apply Pearson criterion, the calculation of which showed that according to cognitive criterion it makes 104,6, motivational – 76,4, activity – 151,9, personal-reflexive – 93,6. The obtained results prove that experimental factors influenced the formation of information competence of future technology teachers in the course of educational stage.

The results of the study are graphically shown in Fig. 6.

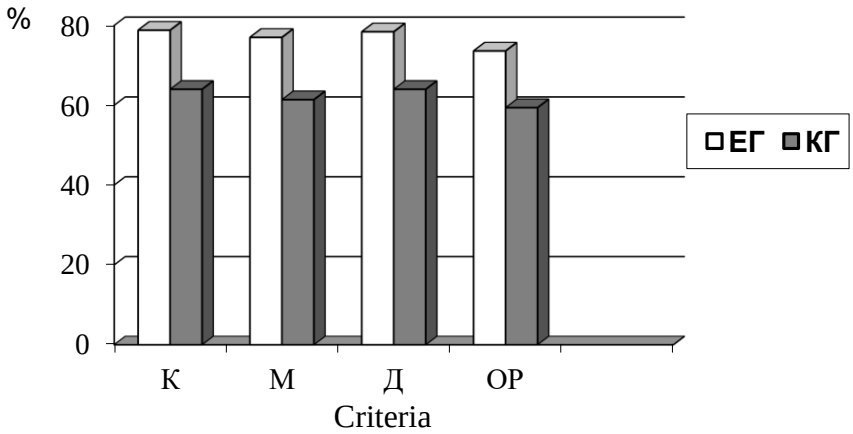

Fig. 6. Levels of formation of information competence of future technology teachers based on the results of educational experiment

Figure 6 clearly shows high level of formation of information competence of future technology teachers according to cognitive, motivational, activity, personal-reflexive criteria in experimental group

and middle in control group and a significant difference between the indicators. The difference between cognitive criterion of experimental and control group is 14.8%, motivational – 16.4%, activity – 14.4%, personal-reflexive – 14.2%. This means that there is a significant difference between levels of formation of information competence of future technology teachers according to cognitive, motivational, activity, personal-reflexive criteria.

According to the results of the conducted educational experiment, the indicators of formation of information competence of future technology teachers are generalized and their distribution by levels is conducted, which is shown in Table 5.

Table 5. Levels of formation of information competence of future technology teachers (educational experiment)

Levels	Experimental group	Control group	Difference, %
Low	67 (23,5%)	134 (49,63%)	26,13
Middle	147 (51,6%)	127 (47,04%)	4,56
High	71 (24,9%)	9 (3,33%)	21,57

Educational stage of the experiment showed high level of formation of information competence of future technology teachers according to cognitive, motivational, activity, personal-reflexive criteria in experimental group and middle - in the control group.

Thus, according to the results of comparative analysis of ascertaining and educational stages of experimental work, there is a change in the levels of information competence of the students of EG from low to high. In control group – from low to middle. The results of the experiment point to the effectiveness of the method of professionally-oriented training of information technology disciplines of future technology teachers, and to positive changes in the level of formation of their information competence in experimental group.

The dynamics of the levels of formation of information competence of future technology teachers is shown in Table 6.

Table 6. Dynamics of the levels of formation of information competence of future technology teachers

Levels	Ascertaining experiment	Educational experiment	Increase	Ascertaining experiment	Educational experiment	Increase
	KG			EG		
Low	167 (61,85 %)	134 (49,63%)	-12,22	169 (59,3 %)	67 (23,5%)	-35,8
Middle	99 (36,67 %)	127 (47,04%)	10,37	113 (39,65 %)	147 (51,6%)	11,95
High	4 (1,48 %)	9 (3,33%)	1,85	3 (1,05 %)	71 (24,9%)	23,85

Analysis of data in Table 6 showed that as a result of experimental work students of experimental group showed higher rates of formation of information competence. Thus, in experimental groups, high level of formation of information competence increased compared to ascertaining stage by 23,85%; middle – by 11.95%; low decreased by 35.8% after educational experiment. In control groups, high level of information competence increased by 1.85%; middle – by 10.37%; low decreased by 12.22%.

Consequently, the results of experimental verification of the methodology of professionally-oriented training of information technology disciplines of future technology teachers confirmed its effectiveness, which is expressed in positive dynamics of formation of information competence of students of experimental group in comparison with control group and higher level of formation of criteria of information competence: cognitive, motivational, activity, personal-reflexive.

According to statistical estimates, changes in the levels of formation of information competence through the introduction of a method of professionally-oriented teaching of information technology disciplines of future technology teachers are statistically significant, that is, they are reliable.

We concluded that the results obtained confirm the effectiveness of implementation of the methodology, its impact on increasing level of formation of information competence of future technology teachers in the process of professional training.

Conclusions.

Thus, the criteria of formation of information competence of future technology teachers are identified. They are: motivational, cognitive, activity and personal-reflexive. By the strength of manifestations, frequency and intensity of indicators of each of the defined criteria, levels of formation of information competence of future technology teachers are high, medium and low. The method of professionally-oriented training of information technology disciplines of future technology teachers is grounded, which includes: designing of the content, integration of traditional and innovative organizational forms and methods, application of active and interactive teaching technologies; its functions, tasks, a set of necessary and sufficient, special professional knowledge and skills that are formed in the logical-built process of studying information technology disciplines are defined.

The basis for testing the effectiveness of the method of professionally-oriented training of information technology disciplines of future technology teachers is the following criteria: motivated professional actions; level of mastering professional knowledge and skills; the degree of readiness for innovation and manifestation of independence, creative activity, self-organization.

Quantitative and qualitative analysis of the results of research-experimental work confirmed the effectiveness of the method of professionally-oriented training of information technology disciplines of future technology teachers. According to the results of educational stage of the experiment, positive dynamics of high level of formation of information competence of future technology teachers has been revealed. Thus, in experimental groups, high level of formation of information competence increased by 23.85% in comparison with ascertaining stage; middle – 11.95%; low decreased by 35.8%. In control groups, the dynamics is insignificant.

Consequently, the results of the experimental verification of the methodology of professionally-oriented training of information technology disciplines of future technology teachers confirmed its effectiveness, which is expressed in positive dynamics of formation of information competence of students of experimental groups in comparison with control ones.

The conducted research does not exhaust all search-research aspects of the problem. Theoretical and methodological aspects of teaching information technology disciplines under the conditions of distance learning by future technology teachers need further analysis, formation of information competences of both technology teachers and teachers of other areas.

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