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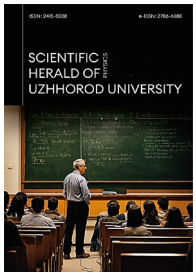

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Methodical system of teaching students computer science: competence-based approach

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Abstract

Relevance. This study investigates the relevant issue of training specialists with knowledge and ability to apply information technologies in professional activities. The relevance of this study is conditioned upon the national programmes and regulatory documents adopted in recent years in the field of education and the importance of being capable of using and studying computer science in modern times.

Purpose. The purpose of this study lies in developing a methodological system for teaching students in a competency-based approach, which would maximise the impact on the quality of education and the level of proficiency in computer science.

Methodology. The following general scientific methods were used in this study: logical-historical, pedagogical observation, analysis, synthesis, systematisation and generalisation, methods of mathematical statistics, as well as the Help&Manual programme. The use of the created methodological system was carried out involving students of Nasirdin Isanov Kyrgyz State University of Construction, Transport and Architecture, Kazakh University of Transport Communications, Almaty University of Power Engineering and Telecommunications named after Gumarbek Daukeyev in 2018-2019.

Results. The result of this study is the motivation-target, content, activity-based, and evaluative-reflexive components of the methodological system highlighted by the authors, each of which is characterised quite succinctly and accessibly. The authors of this study covered the role of the course of computer science in the development of students' skills in using the possibilities of information technology in the professional sphere, the development of instrumental competencies.

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Conclusions. During the study, a model of the methodological system of teaching students was created, which was based on factors, conditions, principles, and criteria of methodology, competencies, and the level of their development, forms and methods of teaching. The results obtained can be used in the methodological work of university teachers and in advanced training courses for schoolteachers.

Keywords: didactics; informatisation of education; information and communication technologies; pedagogical principles; interactive methods; electronic educational and methodical complex.

Introduction

In the era of globalisation and high technology development, the study of computer science is becoming a priority. Mastery of digital technologies helps increase the number of specialists who operate with knowledge in their professional activities. The expansion of the scope of information technology necessitates the introduction of new requirements for the training of specialists, which makes the issue of informatisation of education relevant. The main problem of education is that the future specialist needs to develop critical thinking skills, the ability to cooperate and navigate information [1]. Mastering and studying computer science by students using a competence-based approach implies the use of cognitive, skill, and personal components to improve the quality of professional training. It includes cognitive (knowledge), activity (skills, experience), motivational (communicative and organisational qualities), and psychological components (speed of thinking) [2-5].

The competence-based approach allows expanding interdisciplinary connections, where the main one is to strengthen ties with other disciplines, including those that differ beyond the main sphere. Interdisciplinary branches allow expanding the educational space, creating a virtual space that helps use knowledge from different fields in professional development and activities [6-8]. Researchers of the Alisher Navoi Samarkand State University reveals the role of using active methods, namely problem education. During this type of computer science study, project methods and business games are used. According to the researchers, it is these methods of the competence approach that improve students' concentration on educational material and the use of knowledge in real situations. Furthermore, the project method develops creative skills in the educational process since there is a need to create presentations or video materials [9]. A.A. Akhsutova [9] believes that the most necessary method in the study of computer science is Internet lessons that help use search skills, select and analyse information material, solve problem situations. In the context of a competence-based approach, the development of such qualities as the ability to quickly adapt and independently acquire knowledge; the ability to overcome difficulties unassisted; quickly create new ideas and think creatively; put forward new hypotheses and argue conclusions [10].

The introduction of new requirements for the training of specialists is also conditioned upon the need for the development of universal and professional competencies among trainees. These requirements open the way to the training of specialists who are capable of critically assessing the problematic situations and seeking solutions, correctly navigating the flow of continuously accumulating information. Currently, it is necessary to develop a culture of using information technology in a person, which presents new challenges for the education system. Among them, the problem of teaching computer science in the context of a competence-based approach is becoming more relevant. Furthermore, there are many contradictions today. Firstly, there are problems with the training of highly professional specialists and the level of preparatory material. Secondly, there is a need for a profile orientation of the course and a focus on use in practice, as well as the development of the fundamental foundations of the course. Thirdly, there is a problem between the implementation of a competence-based approach to teaching computer science and the lack of scientific and methodological material and justification for teaching students [11].

Therefore, the purpose of this study lies in the development of a methodological system for teaching students in a competency-based approach, which would maximise the impact on the quality of education and the level of proficiency in computer science. The following tasks were set for this study:

1. Search for the necessary information about the methodology of teaching computer science to students.
2. Analysis of available methods of teaching computer science.
3. Analysis of data on the quality of training using different methods.

I.B. Gotskaya [12], Ye.I. Guzhvenko [13], V.I. Zozulya [14], T.D. Morozovskaya [15], etc. made a considerable contribution to the development of the concept of a methodical system of education. I.B. Gotskaya [12], exploring the methodological system of teaching pedagogical university students, focuses on the application of a marketing approach to the design of content, methods, forms, and means of teaching computer science. Ye.I. Guzhvenko [13] considers the main vectors of coordinating the activities of computer science and information technology teachers in a military university. V.I. Zozulya [14] considers the methodological system of teaching computer science to students at humanities universities for level differentiation and individualisation. T.D. Morozovskaya [15] considers the methodological system from the standpoint of teaching computer science to students at economic universities.

Materials and Methods

The object of the study of the system for teaching computer science were students who took part in a survey and determined the efficiency of methods, as well as the process of finding ways to implement a competence-based approach to learning utilising a methodological system for teaching computer science. The subject of this study is the process of developing a methodological system for teaching computer science to students in the context of a competence-based approach that will positively affect the

study of computer science. During this study, scientific articles, books, publications, dissertations, as well as electronic resources were used, which allow analysing information and identifying the main methodological approaches to the study of computer science using a competence-based approach. Furthermore, the following general scientific methods were used: the logical-historical method (improvement of methods over time), pedagogical observation (positive or negative impact on students), analysis, synthesis, systematisation, and generalisation, methods of pedagogical experiment, methods of mathematical statistics.

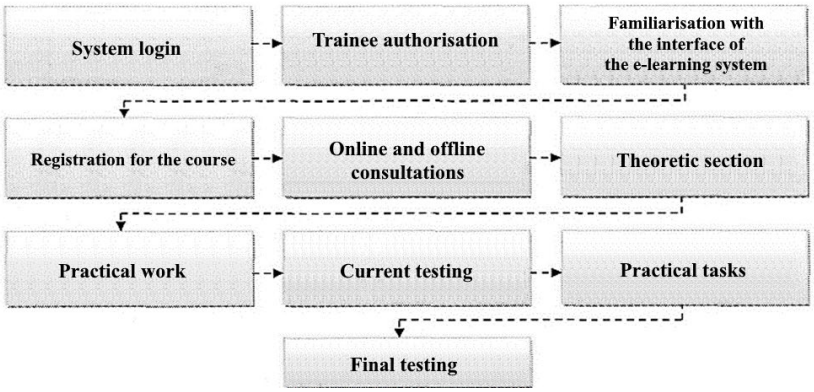
Theoretical methods were also used (psychological, methodological, and subject literature was analysed, including state standards and textbooks), empirical methods (monitoring the progress of educational processes of students' activities, modelling to test the efficiency of the competence-based approach) and statistical methods (systematic and qualitative analysis). Using the general scientific methods of analysis and synthesis, the following tasks were performed: the study of the role of higher education in the training of highly qualified personnel; the essence and meaning of the competence-based approach in higher education. The scientific method of generalisation allowed reviewing the scientific and methodological works on the development of a pedagogical system. The application of scientific methods of systematisation and classification allowed determining the principles of developing a methodological system for teaching computer science to students of technological specialities. A logical approach allowed explaining the essence of the methodological system theoretically. The historical approach allowed the authors to study this issue from the standpoint of the establishment and development of this concept.

During the study, the authors analysed the scheme of the organisation of computer science training of future teachers during project activities in the conditions of a competence approach. In addition, systematisation and generalisation allowed listing several requirements that computer science classes should meet, as well as the components of teachers' professionalism (key, pedagogical, subject competencies). Therewith, based on information materials and diagrams, the quality of training sessions in using role-playing games, as well as the quality of the implementation of the methodological project, was analysed. Proceeding from the materials of Ye.G. Doroshenko et al. [16], a cluster methodological model of training organisation was used. The model of the methodological system included several components that affect the teaching of computer science, and which show the planning and organisation of the learning process. During the study of the first component, the principles, factors, conditions, and criteria for the effectiveness of the educational process of students were identified and analysed. In the second component, the stages of teaching computer science to students were identified, as well as the levels of assimilation of educational material (reproductive, productive, and creative) were determined and characterised. One of the research methods was the modelling of the methodical system of teaching computer science to students, during which the structure of the educational process, modern teaching methods, the use of electronic educational and methodological complexes were highlighted.

Results

From Latin, "competence" means a range of issues in which a person has the maximum knowledge, experience, and is knowledgeable. It is the information and communication competence that includes the ability of students to analyse, use, and transmit information. The technology and model of using the electronic learning model underlies the modern methods of studying computer science [17-19]. In addition, competence is the ability to carry out work and use knowledge in the acquired competence [20]. It includes:

- educational and methodical complex, which includes practical and lecture classes;
- the organisation of the educational process is phased (Figure 1) [19].



In Table 1, one can see the basic and special competencies of a computer science teacher that students must have to master the speciality:

Table 1. Basic and special competencies of a computer science teacher

Basic competencies	Special competencies
Formation of data models	Data models and their structure

Data research	Data classification, search and sorting
Database design	Types of models
Database creation	Methodology and technological process of data creation
Information systems design	Design tools
Documentation of information systems	Documentation development
Database teaching	Development of programmes for the educational system

Source: T.O. Sundukova [20].

During this study, mainly modern teaching methods were used: discussion, game technologies, and the project method. Computers, electronic libraries, and textbooks should be used in the classroom, and students should independently search for information and freely express their thoughts. At the search and analytical stage, the explanation of information and analytical competence and the level of development of information and analytical competence were covered. At the experimental stage, information and analytical competencies were implemented, and at the theoretical and generalising stage, the interpretation of the data obtained during the study was carried out. The pedagogical conditions under which an effective influence on education can be observed were also highlighted, namely the joint activity of the teacher and the student (which are aimed at a high level of professionalism) and the construction of educational tasks [14]. Based on the data of Ye.G. Doroshenko et al. [16], it can be concluded that the cluster model of the organisation also has a major influence (Figure 2), which is based on the principle of innovative and cognitive learning. They include:

- the principle of the mental germ (formation of the foundations for learning);
- the principle of evolution (development of teaching methods and fundamentals);
- the principle of diversity (the formation of many ideas);
- the parts-whole principle (develops skills of analysis and synthesis);
- the principle of generalisation (highlighting the main thing).

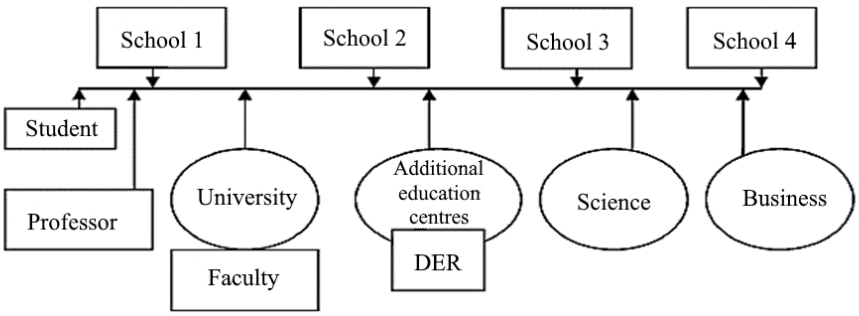


Figure 2. Cluster learning model

During the analysis of information, it is also necessary to identify the structural parts of the model of professional competence formation and 3 interrelated groups of conditions: organisational and methodological, technological and reflexive. Furthermore, the criteria of professional competence can be distinguished: motivational (awareness of the meaning of the profession), cognitive (awareness of the importance of computer science knowledge), operational (a set of professional skills), creative and personal (development of personal qualities) [21]. Based on the analysis of the literature and the methodological system, a methodological system for teaching computer science was developed (Figure 3).

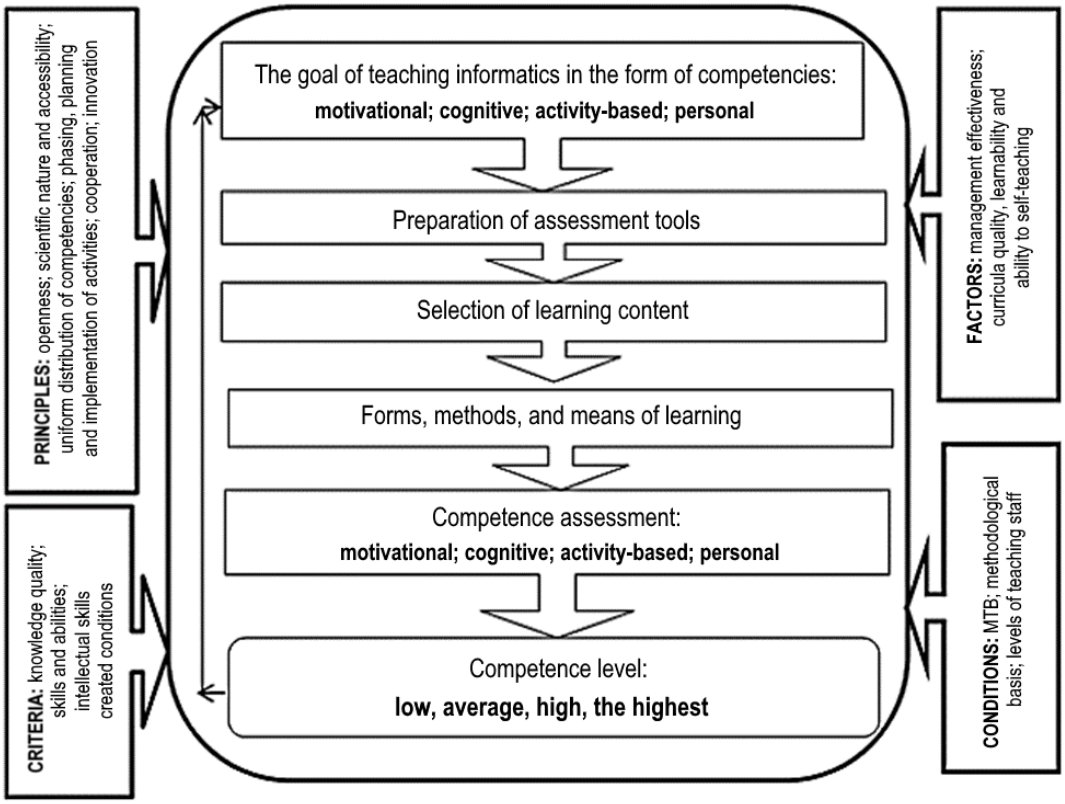


Figure 3. A model of a methodological system of teaching computer science

This methodological system allows determining the level of development of educational material, namely reproductive (poor knowledge of computer science, poor use of knowledge in practice), productive (the desire to study the course and the ability to apply knowledge in practice and in case of problems), creative (high level of motivation and development of creative thinking). It comprises two parts, which include factors that affect the effectiveness of training and the process of organising training itself:

1. Components affecting the efficiency of computer science education:

- principles: they should be guidelines and leading ideas in the organisation of computer science education;
- factors: the main factors influencing the increase in the efficiency of computer science education include the quality of software, the effectiveness of educational process management, the independence of educational work, and student learning;
- conditions: computer and multimedia technologies can be singled out as the main conditions for the implementation of a methodological system of teaching computer science;
- criteria: the criteria for the efficiency of the educational process are as follows: the quality of students' knowledge, characterised by volume, depth, consistency, flexibility; practical skills of trainees, showing the development level of their educational activities; intellectual skills characterised by the ability of analysis, generalisation, systematisation, which develop memory, speech, thinking, attention of students [22].

2. Planning and organisation of the computer science learning process. This part includes the following steps:

- goals and objectives of the methodical system of teaching computer science (educational, developmental, educational);
- preparation of assessment tools;
- selection of the content of computer science education;
- choice of forms, methods, and means of teaching ICT (information and communication technologies);
- assessment of competencies;
- levels of competence development.

Using the Help&Manual programme, an educational and methodological complex was developed for students of technical fields who study computer science. This programme can be used to perform the following tasks: execution of software products; working with graphic images; software management; design; mounting files; exporting files; working with animated objects. The main experiment was conducted for 2 years from 2017 to 2019. During this experiment, the methodological system was tested. The search experiment was conducted at the Kazakh University, where the participants of the experiment were first-year students of the speciality 5B071800 – "Electric Power Engineering". The components of the specified competence were defined in the formulation of the learning goal. The motivational component determined students' interest in problematic issues; incentive points; interest in studying the subject; analysis of existing automated systems. In the cognitive

component, the formed knowledge, skills, experience were identified, according to which it is possible to determine the development of this competence. The activity component shows the level of skills to apply the acquired knowledge in practice, to find the necessary information to solve problems. Students should learn how to search for information, store, process, and transmit information through a computer network. The personal component is formed in the process of creative activity. For this purpose, situational tasks for the computer science course are proposed, for example, students have created an algorithm for conducting a video conference using the Zoom platform. According to the results of studying the computer science course, an exam was organised. The results of the study were followed by Table 2.

Table 2. Results of the search experiment

Kazakh University of Transport Communications	Number of students	Levels of competence development					
		Reproductive		Productive		Creative	
	49	Number of students	%	Number of students	%	Number of students	%
		6	12.2	26	53.1	17	34.7

From this experiment, one can see the number of students with a productive level of competence development considerably higher than reproductive, which affects the quality of education and the level of knowledge of computer science students. This system can be used in other universities to form universal competencies. Furthermore, the development of competencies affects the positive motivation of students to learn. The created methodological system was used in the training experiment. The study was conducted at the Nasirdin Isanov Kyrgyz State University of Construction, Transport and Architecture, Kazakh University of Transport Communications, Almaty University of Power Engineering and Telecommunications named after Gumarbek Daukeyev in 2018-2019. A total of 288 people took part in the experiment. At the beginning, a preliminary diagnosis of the level of preparedness of students was carried out, the results of which are included in Table 3.

Table 3. Preliminary and final diagnostics of the level of preparedness of students

University	Gr	Number of students	Data before the experiment						Data after the experiment					
			Reproductive	%	Productive	%	Creative	%	Reproductive	%	Productive	%	Creative	%
Kazakh University of Transport Communications	E	62	28	45.2	24	38.7	10	16.1	15	24.2	29	46.8	18	29.0
	C	59	27	45.8	24	40.7	8	13.5	21	35.6	28	47.5	10	16.9
Nasirdin Isanov Kyrgyz State University of Construction, Transport and Architecture	E	38	16	42.1	16	42.1	6	15.8	9	23.7	18	47.3	11	29.0
	C	36	15	41.7	16	44.4	5	13.9	13	36.1	15	41.7	8	22.2
Almaty University of Power Engineering and Telecommunications named after Gumarbek Daukeyev	E	46	19	41.3	20	43.	7	15.2	12	26.1	23	50.0	11	23.9
	C	47	19	40.4	21	44.7	7	14.9	17	36.1	21	44.7	9	19.2
Total	E	146	63	43.1	60	41.1	23	15.8	36	24.7	70	47.9	40	27.4
	C	142	61	43.0	61	43.0	20	14.0	51	35.9	64	45.1	27	19.0

The generalised data show that the methodical system of teaching computer science allows successfully mastering the course of computer science, forming knowledge, developing creativity and motivation of students to more successfully apply the acquired knowledge in solving life problems. The following works were performed in the learning experiment:

1. Study of the conditions for the introduction of a methodological system (ICT technologies, Internet, methodological security).

2. At the beginning of the experiment, the teachers thoroughly explained to the students the competencies being formed, how these components are formed, and which components are included in these competencies.

3. During the training sessions, active and interactive teaching methods, group work, and problem-based learning methods were mainly used. Students have learned to express and defend their opinions, to formulate statements accurately, to speak so that they are understood. By taking part in discussions, in group work, students began to recognise the merits, encourage and approve the successes of their colleagues. Joint work in solving the problems set, in solving the tasks set, allowed choosing the right opinion from different ones and to consider the important thing: if criticism arises, then it is constructive, directed not at a particular person, but at an idea, content.

4. The students of the experimental group were mainly offered case studies, creative tasks, and project work. Such tasks are valuable for students in the development of their professional and life skills. In such cases, the tasks contribute to increasing the interest of students in studying the computer science course.

5. Assessment in teaching computer science was carried out comprehensively, using different methods and assessment tools. Teachers carried out continuous assessment at all stages of the educational process.

Figure 4 demonstrates that 85% of students conducted classes at an average and high level of quality in the context of the implementation of the methodological project. This means that when using the methods of projects, discussions, and issues, the level of completed tasks has increased.

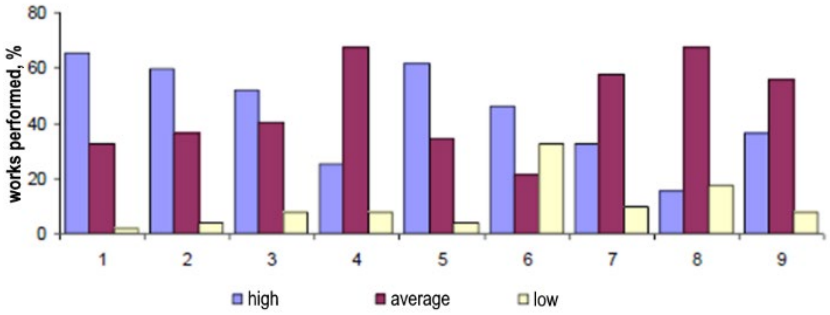


Figure 4. Indicators of the quality of students' implementation of the methodological project

Discussion

In the educational system of universities, the issue of the development of information competence is of immense importance. This concept has been widely investigated by scientists from the USSR, Kyrgyz and Kazakh researchers have also actively studied this subject: A.Sh Bakmayev [17], A.A. Akhsutova [23], M.U. Kasymaliev [24], A.D. Ongarbayeva et al [25]. Information competence implies the ability to work with current information technologies (mobile phone, computer technology, audio and video recording, e-mail, media, Internet) [26; 27]. A competent specialist should be able to search, analyse, and select the necessary information, transform, save, and transmit it using various means [23]. The study of the terms "system", "pedagogical system" was devoted to their research by leading scientists-teachers: Ye.I. Guzhvenko [13], A.Sh Bakmayev [17], I.B. Aminov [28] showed the learning goals laid down in the basis of the pedagogical system, P.V. Nikitin [6] – the role of interdisciplinary connections, and N.V. Kuzmina [29] – functional components. As the researchers note, the methodological system forms part of the pedagogical system and comprises the same components as the pedagogical system. The issues of improving computer science education in the context of a competence-based approach are regularly raised by university teachers, scientists, and researchers in the field of computer science. N.S. Prokopova [30] suggests using non-conventional, active, and interactive methods and forms of teaching.

T.D. Morozovskaya [15] suggests using an educational and methodological complex, including a hypertext textbook containing theoretical material, examples of problem-solving, a system of training exercises and control tasks, control questions. I.B. Aminov [28], R.A. Teregulova [31], A.A. Sydykova [32], M.U. Kasymaliev [24] and others believe that to improve computer science teaching, it is necessary to use problem-based learning, project method, business games, integrated lessons, electronic textbooks, computer training programmes, Internet classes in computer science. Based on the analysis of scientific data, theories and concepts outlined by A.Sh Bakmayev [17], methodological systems and ideas of personality development, personality activity, as well as ways of using information and communication technologies in professional education were highlighted, systemic and integrative approaches were also highlighted. The study suggests that the competence approach means a change in the structure of learning. Preliminary control and verification of students' skills and knowledge helps identify initial and basic knowledge in the field of computer science. Accordingly, it allows conducting an individual educational trajectory. Furthermore, a positive aspect in the new methodological system is to draw up the objectives of classes together with students, based on the subject. This allows students to develop a positive motive. In addition, it is effective to use paired works of students,

which allow them to work better on the problems posed [9; 33]. The considered recommendations of scientists on improving the process of teaching computer science allows outlining ways to improve the methodological system of teaching computer science.

The development of critical and cognitive thinking among students underlies the project method. They allow maximising and unleashing one's creative potential. A study by T.N. Kopysheva, T.V. Mitrofanova, K.N. Fadeyeva [1] showed that the use of this method allows students to develop responsibility for the result and quality of work in junior courses. Therewith, the student demonstrates social, economic, professional qualities of the appropriate level. Proceeding from the research conducted by M.G. Fidarova [10], Ye.I. Guzhvenko [13], Ye.G. Doroshenko et al. [16], the constant use of the project method with a competence-based approach has a positive effect on the adaptation of students to the study of computer science and accelerates the increase in the level of knowledge in this area. Independence and the ability to create innovative ideas are also developing [10]. It is the introduction of applied presupposing skills that improves the quality of training and knowledge in computer science. As a result, highly specialised specialists are formed who have great skills. In the same process, there are several contradictions because now there is a change in the methodology of studying and teaching not only computer science, but also other specialities. Such problems include a discrepancy between new methods and educational material, as well as a discrepancy between the knowledge of graduates with the requirements of the labour market [34].

The analysis of the literature allows noticing three different meanings of the term "methodical system of education". Some researchers claim that the methodical system of teaching is part of the pedagogical system. Other authors tend to adapt to the scientific term "Methodology" and rely on its components to characterise the methodological system. Still others use the structural components of the methodology in the form of goals, content, methods, means and forms of training, control and verification of learning outcomes [25; 35; 36]. During the study, a methodological system was developed, which characterised the criteria of education (quality of knowledge and skills), principles (scientific and accessibility, phasing, planning and implementation, innovation), factors (management efficiency, quality and learning ability), conditions (methodological base). Furthermore, the main components were the purpose of teaching computer science (motivational, cognitive, activity and personal). After its determination, assessment tools are being prepared and the training content is selected, which includes forms, methods, and means of teaching. After these components, the assessment of competencies (which were exposed in the learning objectives) and the determination of the level of competence development begins.

The key element of the research was the application of novel approaches, such as the preliminary control of knowledge, discussion and formulation of the problem with students, organisation of group and pair work, as well as evaluation of work results. Another point was the use of exclusively new teaching methods aimed at using knowledge in life situations: discussion, problem-solving, game technology, case technology, project method, as well as the use of computers and electronic textbooks. Thirdly, the main thing was to ensure the effectiveness of the educational process and the active interaction of the teacher and the student. Joint work in solving the problems set, in solving the tasks set, allowed choosing the right opinion from different ones and to consider the important thing: if criticism arises, then it is constructive, directed not at a particular person, but at an idea, content. The teachers, observing the work of the groups, tried to support the discussion by advising them, suggesting the vectors of the discussion, encouraging and guiding students, stimulating and encouraging their achievements. A healthy environment of work on solving the problems set allowed successfully achieving the purpose set. Using this educational and methodical complex, students perform the following activities: execution of software products; work with graphic images; software management; design; installation of files; export of files; work with animated objects.

Conclusions

In the context of globalisation, the process of informatisation is in the first place, since the ability to work with computer technologies is used everywhere. Proceeding from this, a methodological model of teaching computer science in the context of a competence-based approach was created. The developed methodological system of teaching computer science allows students to successfully form the skills and experience of acquiring knowledge, abilities, and creative activity. The purposeful application of the methodological system allows students to express interest in finding the necessary information to solve the problems that have arisen, their initiative, criticality to consider issues, which is an important feature of developing the key competencies. The proposed ways to improve the methodological system of teaching computer science at a technical university allow building an educational process with a focus on the development of key and subject competencies; to use modern teaching methods focused on the use of acquired knowledge in life situations; to widely use electronic educational and methodological complexes to ensure the efficiency of the educational process.

The development of universal and professional competencies in teaching computer science can be achieved by the purposeful use of active and interactive teaching methods, the organisation of group and pair work. The use of evaluation tools according to the selected components provided a high level of competence in computer science. Furthermore, during this study, scientific literature was analysed, as well as diagrams that show the quality of students' implementation of the methodological project and the stages of organising the educational process using an electronic system. Considering modern trends in pedagogical theory and practice, based on a systematic, personal and competence approach, a model for the development of professional competence of a future computer science teacher or a person who uses information technologies, the structural components of which are targeted, meaningful, operational, effective, is theoretically substantiated. In

general, the search experiment allowed drawing the following conclusions:

1. The methodical system of teaching computer science developed by the authors can be used in the educational process of technical universities for the formation of universal, activity, motivational, and personal competencies.

2. The competence-based approach to teaching computer science, the development of competencies through components, allowed systematically monitoring the process of learning computer science and manage it depending on the level of knowledge of students.

3. The development of competencies is ensured by the activation of cognitive activity of students, positive motivation to study the course of computer science, the formation of mental operations.

Acknowledgements
None.

Conflict of Interest
None.

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Методична система навчання студентів інформатики: компетентнісний підхід

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Анотація

Актуальність. Дане дослідження присвячене актуальній проблемі підготовки фахівців, які володіють знаннями та вміннями застосовувати інформаційні технології у професійній діяльності. Актуальність дослідження обумовлена національними програмами та нормативними документами, прийнятими в останні роки в галузі освіти, а також важливістю вміння використовувати та вивчати інформатику в сучасних умовах.

Мета. Метою даного дослідження є розробка методичної системи навчання студентів на основі компетентнісного підходу, яка б забезпечила максимальний вплив на якість освіти та рівень володіння інформатикою.

Методологія дослідження. У дослідженні використано такі загальнонаукові методи: логіко-історичний, педагогічного спостереження, аналізу, синтезу, систематизації та узагальнення, методи математичної статистики, а також програма Help&Manual. Використання створеної методичної системи здійснювалося за участю студентів Киргизького державного університету будівництва, транспорту і архітектури імені Насирдіна Ісанова, Казахського університету транспортних комунікацій, Алматинського університету енергетики і телекомунікацій імені Гумарбека Даукеєва у 2018-2019 роках.

Результати. Результатом цього дослідження є виділені авторами мотиваційно-цільовий, змістовий, діяльнісний та оцінно-рефлексивний компоненти методичної системи, кожен з яких охарактеризовано досить лаконічно і доступно. Автори дослідження висвітлили роль курсу інформатики у формуванні у студентів навичок використання можливостей інформаційних технологій у професійній сфері, розвитку інструментальних компетентностей.

Висновки. У ході дослідження було створено модель методичної системи навчання студентів, в основу якої покладено фактори, умови, принципи та критерії методики, компетентності та рівень їх сформованості, форми та методи навчання. Отримані результати можуть бути використані в методичній роботі викладачів ВНЗ та на курсах підвищення кваліфікації вчителів шкіл.

Ключові слова: дидактика; інформатизація освіти; інформаційно-комунікаційні технології; педагогічні принципи; інтерактивні методи; електронний навчально-методичний комплекс.