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INTEGRATION OF STUDYING THE DISCIPLINES OF DISCRETE MATHEMATICS AND COMPUTER SCIENCE IN THE SYSTEM OF TRAINING IT SPECIALISTS

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Annotations. This paper discusses the issues of integrated study of discrete mathematics and informatics in the system of training IT specialists. The features and possibilities of interaction of such disciplines as computer science and discrete mathematics at the level of study in higher education are considered. The special attention paid to IT specialists is not accidental, since the development of computer technology is one of the most promising areas of science in modern society. The formation of algorithmic competence and systemic thinking, the ability to apply their knowledge not only in the study of individual disciplines, but also in the complex mastering of the disciplines of the entire training program - these are the priority tasks of teachers working with future professionals. Professional competence for graduates of professional educational organizations is specific and meets the requirements for technicians working in the field of information technology. It includes intellectual competence, communication, general cultural, etc. One of the main components of professional competence is intellectual competence, in which the main component for graduates of professional educational organizations is algorithmic. It is this basic competence that is most effectively formed in the integrated study of discrete mathematics and computer science.

Keywords: competence, competence-based approach, algorithmic competence, discrete mathematics, informatics.

INTRODUCTION

The problem of the formation of professional competence in the learning process is relevant in connection with the need to expand the competence-based approach in higher education, the introduction of new generation standards and the improvement or replacement of traditional methods of personnel training. The inclusion of the formal features of the competence-based approach in higher education standards, as well as the reflection of competence-based characteristics in modern educational programs for higher education, is not enough to reorient the training of future specialists both within a separate discipline and in professional modules, does not have a significant impact on the development of professional competence of graduates and its implementation in solving industrial and scientific and technical problems [10].

The special attention paid to IT specialists is not accidental, since the development of computer technology is one of the most promising areas of science in modern society. The formation of algorithmic competence and systemic thinking, the ability to apply their knowledge not only in the study of individual disciplines, but also in the complex mastering of the disciplines of the entire training program - these are the priority tasks of teachers working with future professionals.

Professional competence for graduates of professional educational organizations is specific and meets the requirements for technicians working in the field of information technology. It includes intellectual competence, communication, general cultural, etc. One of the main components of professional competence is intellectual competence, in which the main component for graduates of professional educational organizations is algorithmic. It is this basic competence that is most effectively formed in the integrated study of discrete mathematics and computer science. In this regard, it becomes relevant to develop new tools of a competency-based approach for the formation of professional, and therefore, mainly algorithmic, competence for IT specialists. It is important to teach research

skills, the ability to think and act independently, to lay the foundation for further self-development. And mathematics has a wide range of possibilities for this. When studying it, the formation of algorithmic competence of students is carried out most organically. In the process of studying mathematics, higher education students not only acquire new knowledge and skills to use them in various situations, but also get creative development, they develop flexibility and systematic thinking, the ability to analyze, synthesize, abstract, analogy, they get the opportunity to develop communication skills, creativity, responsibility for the result of activity. A new direction in the formation of a competent specialist technician is the introduction of integrated learning methods into the educational process. Integration sharpens the professional orientation of the studied disciplines and helps to form a holistic view of higher education students about future activities, and also provides them with interconnected declarative and procedural knowledge [12].

The modern period is characterized by numerous integration processes in the economic, information, production and other spheres. The activation of these processes is also taking place in the field of education. The integration trend dominates in modern science, therefore, it should also manifest itself in education. Thus, the interpenetration and integration of various areas in science and education determine the relevance of developing methods for the integrated study of disciplines, as well as diagnostic tools for the results of integrated study. The development of methods for the formation of various components of professional competence is required to improve the methods and forms of training within the competence-based approach in education. In this context, it becomes relevant to create conditions for the development of competencies formed during training in professional educational organizations, and the development on their basis of holistic competence necessary for the effective professional activity of graduates.

MAIN PARTS

Before talking about the methodology of integrated study of disciplines, it should be noted the general requirements for the methodology formulated in [7].

The teaching methodology should take into account the following: the characteristic features of the goals and conditions of the educational process at each stage; – principles of selection and structuring of the content of training at each stage; - motivation of students to overcome difficulties in the learning process; – the content of independent work of students; the ability to diagnose the level of student preparation at each stage of the educational process. One of the main problems in the development of methodology is the problem of structuring and selecting the content of educational material, which is widely discussed in connection with various disciplines and levels of education. At the same time, the logical structure is understood as “a system, sequence, interconnection of the educational material that makes up a single whole” [7].

It is always appropriate to raise the question of the structure of educational material only after clarifying the features of the disciplines being studied. Let us consider the features and possibilities of interaction between such disciplines as computer science and discrete mathematics at the level of study in higher education.

Informatics studies the structure, properties, processes associated with the search, collection, storage, transformation, transfer, use and protection of information in various fields of human activity. The flows of information in the modern world are huge, so the automation of information processes, the development of information and communication technologies, computer technology is both an object and a tool base for informatics. Informatics covers the following sections of scientific knowledge [1, 4, 6, 8, 9]:

1) logical models (deductive systems, various forms of inference);

2) the theory of algorithms (various types of algorithms, problems of computability, complexity of algorithms);

3) databases (data types and structures, information processing in databases);

4) artificial intelligence (various types of information presentation, conclusions, expert systems, training);

5) recognition and processing of images (various methods of recognition, use of virtual spaces);

6) bionics (modeling in biology); theory of robots (autonomous devices that implement planning algorithms, behavior control, etc.);

7) theory of computers and computer networks (information processing, architecture of computer networks);

8) software engineering (programming systems, methods for creating software networks);

9) numerical and symbolic calculations;

10) computational linguistics (translators, text analysis, modeling of language structures);

11) human-machine interaction systems;

12) use of computers in closed systems;

13) neuromathematics and neurosystems.

By itself, this synthetic discipline is a basic tool for the development of students' intellectual abilities. Courses such as algorithmization and programming are especially important and indicative. A lot of problems provided by discrete mathematics, easily solved in the form of software implementation, - contribute to the development of algorithmic competence, the formation of non-standard thinking. In addition, studying the course of the basics of programming allows you to productively use the already studied problems of discrete mathematics. This allows you to achieve a solid assimilation of the material in both disciplines, develop the intellectual abilities of students, and accumulate the experience necessary for future professional activities. Having studied the curricula on the basics of mathematical logic and the basics of programming in higher education, it is easy to see that these disciplines have no common ground either in the time period or in terms of cooperation between teachers. Nevertheless, the combination of these courses seems to be effective enough to achieve a positive result. When breeding, there is no holistic algorithmic competence, but separate sets of knowledge about algorithms, the ability to program, the ability to solve

mathematical problems are obtained. Meanwhile, algorithmic competence implies not only the ability to design an algorithm for solving a problem, but to transform it into a program and get a tested software product [11].

The use of integrated learning, as practice shows, changes the subject area, structure and content of the connected disciplines, the goals and objectives change, the conceptual apparatus and methods for solving educational problems expand. The principles of integrated learning should ensure the achievement of the goal - the formation of algorithmic and development of algorithmic competence of higher education students:

1. Integration of discrete mathematics and computer science contributes to a holistic, systematized perception of the material being studied on each topic, forms the breadth of thinking, its activity and depth.

2. Each lecture lesson is subject to mandatory consolidation in a practical lesson, which enhances the practical orientation of teaching students of vocational education, contributes to the development of critical thinking, the ability to use the theoretical knowledge gained in practice.

3. Previously unused approaches to solving a particular problem, non-standard ways of solving it, the ability to solve this problem by independently choosing methods and techniques, develop flexibility and originality of thinking.

4. Discussion of the chosen decisions develops criticality, responsibility, organization.

5. The desire to find the shortest way to solve the problem contributes to the rationality and purposefulness of thinking.

6. The need to substantiate one's point of view forms the evidence of thinking, makes one make a reasonable choice of actions.

RESULTS AND DISCUSSION

Experience in the integrated study of discrete mathematics and informatics allows us to draw the following conclusions that integrated learning:

1) contributes to the development of the scientific style of thinking of students of higher education;

2) forms a unified approach to the study of disciplines of the natural science cycle;

3) improves the quality of knowledge of higher education students education;

4) forms the conviction of students of higher self-education on the assimilation of rather problematic issues that, with traditional methods of explaining the material, remain misunderstood or not assimilated at all;

5) makes it possible to use computer programs of students, created on the basis of integration in the learning process, in the implementation of the curriculum in the future - when designing term papers and theses, mathematical modeling, numerical programming, building computer models;

7) reveals the practical significance and the undoubted need to study mathematical disciplines by students - future professionals in their field;

8) in the process of solving problems, students of higher education show curiosity;

9) allows you to see the inadequacy of the use of continuous models for the analysis of systems that have a discrete nature, apply discrete models and conduct their computer simulation;

10) assimilate a sufficiently large amount of information, training short-term and long-term memory; develop the ability to systematize knowledge and organize memory with the help of methods, methods and techniques common to disciplines. According to modern scientific data, any information is in RAM for 15-20 minutes, after which it is transferred to storage in RAM. This is the psychological basis for the need to combine certain elements of knowledge, and not only spatial, but also temporal. Therefore, it is so important to use such techniques as solving direct and inverse problems in parallel columns, proving direct and inverse theorems in one lesson, highlighting similarities and differences in features so that verbal formulations are combined with symbolic notation, etc. The application of knowledge gained in theoretical classes in mathematical logic should take place in practical classes on the basics of algorithmization and programming. The course of

discrete mathematics serves as a basis for studying the theoretical foundations of computer science. Almost any of the sections of computer science operates with concepts and applies the methods of discrete mathematics. Therefore, the study of discrete mathematics as a whole is necessary for a deep understanding of the subject and methods of computer science [2, 3, 5, 8].

As a result of mastering the discrete mathematics course, students should understand the relationship between mathematical logic and the architecture of computer systems, know the basics of graph theory and its application in computer science, have a good idea of the role of algebraic systems in building database theory and their relationships with data types, understand the essence of the language of logic predicates, to know its significance for verification and specification of a software product, the theory of algorithms for obtaining a decent software product. Based on all of the above, it can be argued that on the basis of discrete mathematics, it is possible to form a holistic algorithmic competence. As is known, the course of discrete mathematics is based on the course of higher mathematics, and is also connected, and rather closely, with other disciplines of the curriculum. But in addition to communication, it is also fundamental for applied sections of computer science. The course includes sections related to the algorithm - oriented approach in the presentation, as well as the concepts used that arise in one theory and are used in the construction and presentation of other courses. We should not forget about the generalization of concepts and models.

With a coherent presentation of theoretical calculations in terms of time and content, students have an understanding of the analogies of the theories being studied, the connection of the courses being studied, which helps to consolidate the desire to study them. The last remark follows from a survey of students' preferences among the subjects studied. It turns out that in the process of training IT specialists, students do not understand the place occupied by mathematics, physics and some other disciplines. In the case of integrated study (coordinated teaching) of disciplines, their undoubted analogy is considered in the relevant sections [12].

Using an algorithmic approach to the study of discrete mathematics, we will raise the algorithmic, deductive and inductive competence of students to the required level by the beginning of its (competence) implementation in the study of optimization and mathematical modeling in senior years (in teaching a higher level, the competence formed at the previous stages of education is realized , thereby ensuring the development of holistic algorithmic competence). In addition to studying simulation modeling, the acquired skills will be used in studying the theory of queuing and in modeling queuing systems, as well as in numerical methods for solving mathematical problems, where the ability to program creates the required basis for algorithmic competence, on the one hand, and for language competence (proficiency in high-level programming languages) on the other.

CONCLUSIONS

A feature of the study of mathematical and information technology disciplines in the framework of higher education should be their great practical orientation. In the case of studying discrete mathematics and informatics, this is ensured, firstly, by an algorithm - oriented approach in the study of each discipline, and secondly, by studying the theoretical and practical sections of one discipline in a timely and consistent manner with certain sections of the second discipline. This is precisely what the approach called the integrated study of the disciplines under consideration consists of [10].

The prerequisites for such integration are: deep interconnection between the theoretical foundations of discrete mathematics (mathematical logic) and informatics (boolean calculus, bit operations); the need to implement numerical methods and algorithmic solutions of discrete mathematics using computer programs to check solutions and properties of the algorithms under study (from Euclid's algorithm and the "sieve of Eratosthenes" in number theory to algorithms for solving problems in graph theory); solving problems of discrete mathematics related to dynamic systems (recurrent relations), which must be considered over large intervals of discrete time, which is practically impossible without software implementation by means of computer science; wide possibilities of information

technologies for displaying discrete mathematical objects considered in various sections of discrete mathematics (from graphical representation of numerical sequences to visualization of multi-vertex graphs and three-dimensional representations of polyhedra); the need to find solutions to complex problems of discrete mathematics that do not have an analytical solution and cannot be solved "manually" using software-implemented algorithms (from constructing high-order Venn diagrams to the traveling salesman problem or coding theory problems); the growing demand for mathematical description and computer modeling of discrete-event systems in economics, logistics and production, which can only be satisfied by such a unity of discrete mathematics and computer science as simulation modeling. Such modern tasks, which are within the competence of future IT specialists graduating from organizations of secondary vocational education, require that they not only have knowledge of the theoretical provisions and methods of discrete mathematics, but also be proficient in some programming languages and information technology tools. In order to become competent IT professionals, graduates must master discrete mathematics and computer science as a single set of declarative and procedural knowledge, be motivated to solve problems within their competence, be willing to overcome difficulties and be able to work as a team in solving collective problems.

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