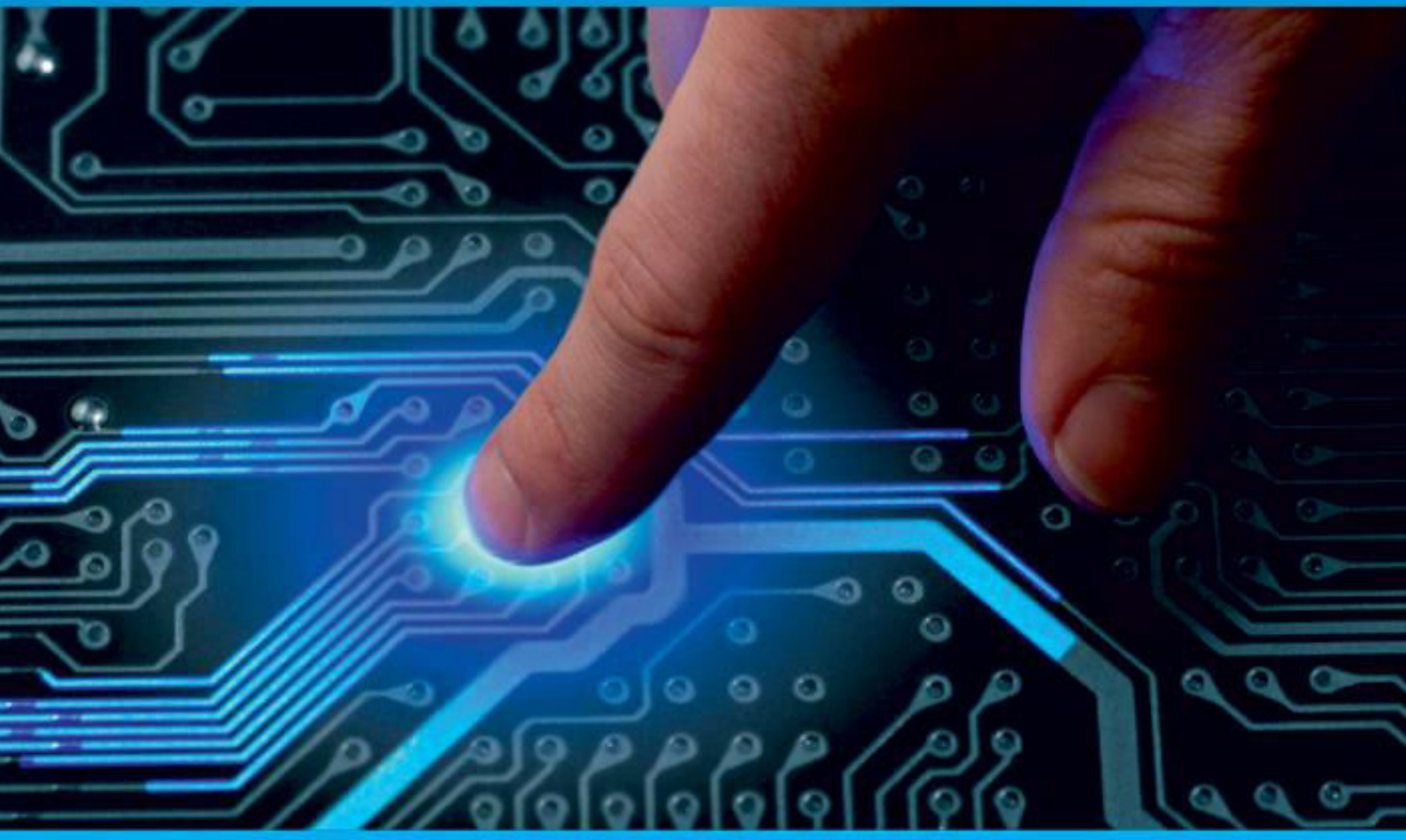
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 10, Issue 9, September 2022

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.165

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 9, September 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1009018 |

The Problem of Professional Teaching Informatics in University

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ABSTRACT: This article discusses the relevance of vocational training in computer science in higher education. Based on the data of pedagogical and information technologies, the author analyzes the problem on the basis of existing scientific literature and explores the specifics of the relevance of vocational education in universities.

KEYWORDS: Informatics, academic lyceum, information technology, educational effectiveness, students.

Today, all universities and colleges of the country pay special attention to computer science. The main reason for this is that it is difficult to imagine our total achievements today without computer science.

bout 80 percent of all jobs in the world today are equipped with information technology. Informatics as a fundamental science is engaged in the development of amethodology for building information support of management processes with any objects on the basis of computer systems.

In Europe, these major research areas in the field of informatics can be distinguished; network structure development, production of computer-integrated processes, economic and medical informatics, social insurance and environmental informatics, professional information systems.

The purpose of fundamental research in computer science is to obtain integrated information about any information system, to determine the unified laws of their construction and operation. Informatics as a field of applied science deals with:

Study of the laws of information processes (collection, processing, dissemination of information);

Development of communication information models in many areas of human activity. The main task of computer science is to develop methods and tools for updating information, as well as the organization of technological processes of information processing and their use

The main tasks of computer science are:

Study of information processes of any nature;

Development of information systems and creation of new technologies for processing information on the basis of processes derived from the study of information processes

Creating and solving scientific and engineering problems in the effective use of computer technology in many areas of public life.

Informatics is a complex field that does not exist on its own, but aims to create new information techniques and technologies to solve problems in other areas

The modern world level of development of information technologies is such that the creation of a national system in the country in accordance with the integration of information space infrastructure and the national information network serves as an important factor in the effectiveness of economy, management, science and education. These problems are quite complex and at the same time relevant for our country. In December 1994, the Cabinet of Ministers of the Republic of Uzbekistan adopted the Concept of the Republic of Uzbekistan. The main purpose of this Concept and the issues raised in it are:

National information -creation of a computer network;

Maintain economic, legal and regulatory documents for the approach to information as a commodity;Adherence to world standards in information processing;

Creation and development of the information industry;

encourage and support fundamental research in the field of information technology;

Coordination of the system of training ofusers of informatics Taking into account the main provisions of the Concept, the "Informatization Program of the Republic of Uzbekistan" has been developed and includes three target programs;

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National Information -Computing Network;

Mathematical and computer software;

Personal computer.

Informing the public and providing them with new information technologies play an important role in meeting people's need for a variety of information.

Because of information, theory combines with practice. Theory of practice cannot exist without practice, it cannot even develop.

The information was distributed differently at different times, and the distributors also looked different.

Information carriers

Informatics emerged in the mid-twentieth century, in the 1960s, in France as a field term for the processing of information using electronic computers. Informatics, which emerged as a new scientific field, was recognized as an important science for the study of information and its properties.

At present, the country pays great attention to higher and secondary special education. Therefore, special attention is paid to the use of the Internet, which is a global information system of computer systems.

The current state of development of computer science is analyzed as follows.

1. High appreciation of computer science as a science and its development.

2. Describe the methods of teaching computer science.

Considering the above processes, the two processes can be studied in several parts.

1. The emergence of computer science;

2. The period of introduction of units and additions to the science of computer science;

3. Development of computer sciencein the XIX-XX centuries;

4. The use of computer science as a direct higher science in the XX-XXI centuries.

Informatics in the broadest sense is a science related to the processing of information in all spheres of human activity, mainly using computers and telecommunications, and reflects the unity of various branches of technology and production.

Its educational role in the teaching of computer science in secondary schools, colleges and lyceums is reflected in the following;

1. Inform students about worldknowledge and change children's worldview;

2. To increase students' interest in computer science;

3. Promoting the rapid development of computer science and the study of computer culture;

4. To develop students' understanding of computer science, to create visual aids on various topics and to use them effectively;

5. O’quvchilardainformatikafanito’g’risidagitushunchasiniyuksaltirishningyanabirusulibumavjudishqurollaridanto’g’rifoydalanaolish.

6. In order to deepen the knowledge of computer science, students should be asked in writing on the topics covered, test questions, oral questions and practical questions from existing computers.

7. A computer science teacher is required to organize more practical lessons so that children canfully master the subject.

In conclusion, it is important to note that information is an important tool for the upliftment and development of society. Such information is one of the most important economic indicators in human history, and the computerization of society is a major driving force in the structural rethinking of the economy

Zhaldak defines information technology as a set of methods, tools and techniques used for collection, storage organisation, processing, transfering and presentation of all kinds of messages and data.

The definition of new information technologies is also provided in the explanatory dictionary [1] as the technology for processing information and solving problems with use of computers, which is based on the achievements of artificial intelligence.

According to Andrey P. Ershov, applied informatics is a set of all types of human activity related to the use of software and hardware of the infosphere. The development of applied informatics finds its expression in the transfer to society of new information technologies of systematic or automated data processing in the interests of a particular human activity

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Laptev, Ryzhova and Shvetckii define informatics as a fundamental natural discipline, the object of which is the information processes that take place in the world. The basic concepts of informatics Laptev, Ryzhova and Shvetckii include information processes, structures of constructive mathematics (constructive objects and constructive processes), computer information models (data structures and algorithms), architecture of computing systems, and computational experiment

We propose the definition of informatics as a complex scientific and engineering discipline, the object of which is information processes of any nature, and the subject is new information technologies that are implemented using computer systems, and the methodology of informatics is a computational experiment.

Ershov notes the relationship of informatics to natural sciences: "Realizing some relativity of the division of science into natural and social, we assume informatics as natural science, according to the idea of the unity of the laws of information processing in artificial, biological and social systems"

Laptev, Ryzhova and Shvetckii refer to informatics as a fundamental science, which reflects the general scientific nature of the concepts of "information" and information processes. As a fundamental science, informatics is associated with many other scientific fields, such as philosophy (in particular, epistemology and the doctrine of information), mathematics (in particular, algebra, mathematical logic and algorithm theory, the theory of mathematical modeling), linguistics (in particular, the doctrine of formal systems and formal languages), as well as information and management theory

Table 1. Equivalence of concepts in mathematics and informatics.

Mathematics	*Informatics*
Algebraic system (Algebraic structure)	Executor (robot, computer, person in a certain role)
Set (Domain)	circumstance
Occurrence of a set	State of circumstance
Operation	Action that change the circumstance
Predicate	Questions to the circumstance
Signature	System of executive commands
Protocol (Sequence of operations and predicates with their values + initial element)	Activity (the sequence of actions and questions to the circumstance, starting from the initial state)
Predicate – precondition	Condition of the problem
Predicate – postcondition	Purpose of the problem
Valid protocol that implements the corresponding predicates of precondition and postcondition at the ends	Solving the problem (activity that leads from a state that satisfies the conditions to a state that satisfies the purpose)
Program (subcursive set, which includes a large number of valid protocols)	Program (finite instruction that defines the activity leading to the purpose for each state that satisfies the condition)

The relationship between computer science and mathematics was also pointed out by Aleksei L. Semenov. He emphasized that informatics has a theoretical core, which is closely related to mathematics, explaining that "the fundamental natural science part of informatics builds theoretical models of the processes of processing, accumulation and transmission of information. By its object, concepts and methods, it is a branch of mathematics. The subject of its study are the final (constructive) objects and algorithmically described (constructive) processes that occur in the environment of these objects" ([17], p. 54). Semenov calls this part of informatics "mathematical informatics" and notes that the foundation of mathematical computer science was laid in attempts to model the processes of human algorithmic activity.

In the development of mathematics as a science, MikhaelGromov notes the role of informatics: "As the body of mathematics grew, it became itself subject to a logical and mathematical analysis. This has led to the creation of mathematical logic and then of the theoretical computer science. ... It absorbs ideas from the classical mathematics and benefits from the technological progress in the computer hardware which leads to a practical implementation of theoretically devised algorithms. ... And the logical computational ideas interact with other fields, such as the quantum computer project, DNA-based molecular design, pattern formation in biology, the dynamics of the brain, etc. One expects that in several decades computer science will develop ideas on even deeper mathematical levels which will be followed by radical progress in the industrial application of computers, e.g., a (long overdue) breakthrough in artificial intelligence and robotics. ... As the power of computers approaches the theoretical limit and as we turn to more realistic

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(and thus more complicated) problems, we face the "curse of dimension" ... Here one needs a much higher level of mathematical sophistication in computer architecture as well as in computer programming ... Successes here may provide theoretical means for performing computations with high power growing arrays of data."

There are higher education institutions of various types in Ukraine. Thus, the training of future teachers is conducted in multidisciplinary (classical) universities and branch (pedagogical). According to the Concept of development of pedagogical education [5], pedagogical education is a system of professional training of pedagogical workers to carry out pedagogical activity. At the same time, the professional qualification of a pedagogical worker is a standardized set of acquired competencies (dynamic combination of knowledge, skills and practical skills, ways of thinking, professional, ideological and civic qualities, moral and ethical values [20]) that is certified by the relevant document and allows to carry out professional pedagogical activities.

The training of future teachers must meet the public demands formulated in professional and educational standards, take into account global trends and recommendations of influential international organizations for teacher training. Teacher training programs contain components of psychological, pedagogical and practical training, including teaching methods and the use of information and communication and digital technologies. Modernization of educational programs should include, in particular, their focus on the formation of future teachers' research skills and mastery of information and communication technologies

The importance of mathematics for the socio-economic and technological development of Ukraine is noted in the Law of Ukraine "On Higher Education", the list of acutely deficient specialties of which includes specialties of the fields of knowledge 01 – Education/Pedagogy, 11 – Mathematics and Statistics, 10 – Natural Sciences and Engineering. In particular, for entrants to natural-mathematical and engineering-technical specialties the corresponding privileges are provided.

The focus on improving the mathematical training of entrants is also reflected in the fact that, starting in 2021, external independent assessment in mathematics in Ukraine will be mandatory. As Liliia M. Hrynevych pointed out, "... from 2021 we plan to introduce a mandatory state final examination in mathematics in the form of external independent assessment. ... Mathematics plays a special role in the cognitive development of children, so its study is extremely important. Basic skills in mathematics are necessary for everyone – it develops logical and abstract thinking. And these are the skills that all people need. And more and more countries are making the external math exam compulsory for all children after school. ... We are now seriously preparing to strengthen from 2021 both the study of mathematics and English. These subjects are extremely important for a person, who wants to be competitive in today's world"

The formation of mathematical competence of pupils requires a high level of professional competencies of mathematics teachers. The Concept of the State Targeted Social Program for Improving the Quality of School Natural and Mathematical Education for the Period up to 2015 emphasized that improving the quality of school mathematical education is a necessary condition for the formation of an innovative society and increasing the competitiveness of the economy. The Program was implemented together with the Action Plan to improve the quality of physical and mathematical education [12], which, in particular, provided for the need:

– to modernize the standards of higher education in the areas and specialties of physics and mathematics, including pedagogical profile;

– to bring the content of school physical and mathematical education in line with the modern development of science and social needs of society, to ensure the applied orientation of the content of curricula in mathematics and natural sciences;

– to improve the content of curricula in basic mathematical disciplines, taking into account the computerisation of all types of engineering activities (discrete and computer mathematics, fuzzy methods and "soft" calculations);

– to provide informatization of higher physical and mathematical education by including in physical and mathematical disciplines laboratory workshops with the system of computer mathematics, means of visualization of calculations;

– to ensure the teachers training for the formation of pupils' skills to interpretate quantitative information presented in tables, charts and graphs; to teach pupils to obtain the necessary information independently, analyze it, perform calculations and choose the best solution.

The realization of the tasks set in the Program and the Plan is impossible without thorough computer training of future mathematics teachers. The analysis of normative documents provides an opportunity to identify the following areas of modernisation of training of future teachers of mathematics:

– improving the system of professional information competencies of future mathematics teachers;

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– introduction of computer mathematics systems in methodical systems of teaching mathematical disciplines with their subsequent transformation into computer-oriented ones;

– renewal of computer-oriented systems of teaching informatics of future mathematics teachers based on the widespread use of models and methods of mathematical computer science, in particular, through the integration of programming systems and computer mathematics in a cloud-based environment.

According to the Decree of the President of Ukraine "On declaring the 2020/2021 academic year as the Year of Mathematical Education in Ukraine", the Cabinet of Ministers of Ukraine developed an appropriate action plan [7] to achieve given aims: ensuring equal access of pupils to mathematics; implementating modern technologies of mathematics; improving resource providing the educational process; increasing the motivation of pupils to study mathematics and its application in life; popularization of mathematics education. Among these actions the such:

– ensuring the introduction of training courses "Logic" and "Mathematical Logic" in the curricula of grades 1-11 of general secondary education;

– organization of summer "mathematical schools" for professional growth and formation of a professional community of teachers;

– development of methodical recommendations and practical tools for the use of interdisciplinary connections of mathematics with other educational disciplines;

– equipping general secondary education institutions with equipment for STEM laboratories.

According to Myroslav I. Zhaldak, such problems become important: 1) integration of educational disciplines, in particular mathematics, physics, informatics and others; 2) differentiation of training in accordance with the inclinations, requests and abilities of pupils. Informatics to some extent solves the problems of such integration, studying the general properties of information processes, laws and rules of search, creation, storage, analysis, systematization, processing, transmission, presentation and use of various messages and data. The integration of mathematics and informatics and other subjects cannot be reduced to their mechanical combining in the existing form. Existing modern computer-oriented methodological systems of training, on the contrary, are aimed primarily at the holistic perception of the studied phenomena, elucidation of their essence, the links between their individual manifestations, in particular: analysis of the semantic side of obtained formal solutions; development of synthetic, figurative thinking along with logical, analytical; abstraction from the technical details of the analysis of models of the studied phenomenon; problem statement; putting forward hypotheses, construction of information (including mathematical) models of researched processes and phenomena; material interpretation of the results obtained with help of computers.

Characterizing the impact of computerisation on mathematical education, Andrey P. Ershov outlines the following areas of influence

Sharp expansion of mathematical practice: "computerization is both a means and an expression of the expansion of mathematical knowledge".

Changing the nomenclature of mathematical knowledge: "Abstractions of human activity, theproperties of artificial and living (biological and socio-technical) systems are included to substantive part of mathematics through programming and construction of information models. All this sharply enhances the role and place of discrete mathematics. This is facilitated by the shift in physics towards the quantum properties of matter".

Systemic role of mathematical theory.

Computational experiment with a mathematical model: "its role in engineering practice is well known"; "its practicality as a new method of cognitive activity in the educational process is also confirmed by pedagogical practice"; "in recent years, the computational experiment has increasingly become a source of purely mathematical discoveries"

Visualization of abstractions "... must be observed at the educational level between the abstract mathematical object and its visual model ... The importance of a bright visible image for the activation of the young mind is well known to every teacher, educator and psychologist".

Dynamization of mathematical objects: "The computer with its means of visualization and computation help the observer to extract from the static packaging of mathematical relations all sorts of trajectories of the dynamic process in time and space, thus enriching his experience, intuition and ability to predict. All this brings the learning process closer to research and experiment".

Formation of a structure out of chaos: "Among the possibilities provided by mathematical experimentation and the ability of the computer to visualize, special mention should be made of experiments to observe the formation of regular structures from the initial disorder. ... Here is formed a completely new and extremely powerful channel for the

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spread of mathematical knowledge to a huge class of natural phenomena: the movement of continents, the formation of the coastline, mountain landscapes, aurora borealis, plant formation, animal coloring, evolution of conflicts and genesis of crises. ... the material supplied by the synergetics and mathematics of the nonlinear give us possibility to draw an important educational conclusion about the fundamental importance of computational experiment as a cognitive tool: if the source of everything new in nature is nonlinearity, then speculative prediction of the extrapolation type is linear in nature and therefore it is limited in its cognitive power, for example, any conclusion in existing axiomatics. Therefore, the extraction of truly new knowledge requires a nonlinear synergistic process either in the human brain or in computer memory".

. Forming of basic abilities and skills: "... a computer with the possibility of direct manipulation with visual images of mathematical objects in artificial worlds can make ... the task of pre-mathematical ... education a subject component of the educational process, especially in primary education and in early adolescence. These are logical tasks and competitions in calculations in mind, drawing up and following the "rules of the game", constructing artificial worlds, direct manipulation with mathematical objects, managing executors, planning their activities and much more".

Awakening of primary interest: "... the dynamic, visual, obedient and stimulating style of computer behavior makes it an ideal tool for awakening the initial interest in mathematics, its beauty, surprise, prophetic power and magical connection with everything around".

Vladimir M. Tikhomirov notes: "Mathematical education should include teaching computers, computer technology and modern information capabilities. These are the trends of the new time, and there is no doubt that the new century will be the age of Computers, as well as the centuries of Steam, Electricity, Atom. And it must be borne in mind that in mathematics itself there are events of paramount importance that must be included in mathematical education (catastrophe theory, fractals, discrete mathematics, etc.)"

Considering the trend of mathematics development, attention is drawn to the close links between mathematics and informatics, which are manifested in the introduction of mathematical methods into informatical disciplines, and informatics methods penetrate into mathematics, influencing the content and means of mathematical activity. This is evidenced by the emergence of a new field – computer mathematics. The use of computers and information technologies make it possible to enrich mathematical science, expand its application, and significantly influence the mathematical activity itself (content, methods and means).

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Impact Factor: 8.165

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ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

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