# THE FEATURES OF MODERNIZATION OF THE STUDY PROGRAM "INFORMATION TECHNOLOGIES IN EDUCATION" WHEN TRAINING TEACHER OF MATHEMATICS AND COMPUTER SCIENCE

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**Summary**

In the article, problems of practice-oriented training of future computer science teachers are discussed. The authors highlight important ways of increasing the effectiveness of training future computer science teachers. It is emphasized that not only the formation of students' knowledge of modern information resources, but also mastering them under the conditions of modern information society is needed. New social and economic conditions require a development of a new content of the educational discipline "Information technology in education". A new IT specialist profile is modeled and discussed.

***Keywords:*** *innovative education, practice-oriented training, curriculum structure, information technologies, teachers training, study program.*

Nowadays when all over the world computer and information technology are rapidly developing, when in Belarus unique legal foundations and opportunities for effective implementation of complex digital transformation of the Belarusian state and society for enhancing the national digital economy competitiveness, the quality of life of the population, and the formation of an IT country and training of IT personnel were created, a deepening of contradictions between the requirements for the personality and activity of a teacher of mathematics and computer science, and the actual level of readiness of graduates of pedagogical educational institutions for the performance of their professional functions are observed. The problems discussed in the given article are highly relevant due to the following reasons: the research topic is not well developed yet in the theory and practice of higher pedagogical education in the Republic of Belarus and is in pedagogical demand.

The innovative education demands the problems of practice-oriented training of future computer science teachers to be implemented. At present, in a number of normative documents (Program of Informatization of Education in the Republic of Belarus, Concept for the Development of Pedagogical Education in the Republic of Belarus, etc.); a special attention is paid to the development of electronic manuals and other pedagogical electronic resources for improving the quality and efficiency of an educational process. Despite studies of Bates A.W. [1, 2015], Андресен Бент Б., Катя Ван Ден Бринк [2, 2007], Захарова И.Г. [3, 2010], Роберт И.В. [4, 2008] and others, the important aspects of future computer science teachers training to use information technologies in education have not been explored yet. The available amount of distributed content frustrates students creating an illusion of easy accessibility of pedagogical information technologies and leveling the processual aspect of mastering them. A necessity of determining methodological basics for the development of scientific and methodic software is appeared.

One of the important ways to increase the effectiveness of training future computer science teachers is not only the formation of their knowledge of modern information resources and systems, but also mastering them under the conditions of the modern information society. An important thing in the future teacher's mastering of innovative technologies is that the process of his education must focuses on the use of innovative technologies that ensures an immersion of the individual into the educational space demonstrating the student a model scenario of his future professional activity.

A scientific novelty of the article is that for the first time conceptual foundations for the development and implementation of electronic navigator of pedagogical technologies as an innovative tool for the practice-oriented training of future teachers will be created.

Efficiency and innovativeness of the projecting electronic navigator of pedagogical technologies is ensured not only with the expert selection of the content and use of pedagogical technologies, but also with involving future teachers in solving typical professional tasks.

The above proves the need of substantiation and development of a new content of the educational discipline "Information technology in education". A successful implementation of these tasks will be certainly be promoted by the participation of the Belarusian State Pedagogical University in the Erasmus+ project "Innovative Education for Social-Economic Development (IESED)" (head organization - Alytaus Kolegija).

With the assistance of all participants of this project, the IT specialist profile was modeled.

**IT specialist must:**

1. Analyze perspectives and directions of development of information systems and technologies
2. Develop data structures for use in information systems, operational analysis systems and intellectual systems

3. Perform modeling, design of software tools and documentation to support activities in various subject areas

4. Perform comprehensive testing of the developed software products and applied software

5. Plan and organize automated support of various activities

6. To be able to apply basic scientific and theoretical knowledge to solve practical problem

7. To be able to work independently and in a team

8. To be able to generate new ideas focusing on creativity, critical thinking, communication and collaboration.

9. Build and optimize models of various systems and processes

The curriculum structure was agreed as well. There was developed the program "IT-technologies in Education". In most of the existing curricula across this discipline, the priority is given to studying information technologies for processing different types of information. However, by the time the discipline "IT-technologies in Education" to be studied, the students of the Physics and Mathematics Faculty have already mastered these technologies. So when developing our program the emphasis was made on the pedagogical component of using modern digital technologies in education. A plan of this course is the following:

**Table 1. Plan of the course**

| Year of study | Semester | Academic hours | | | | | Hours of course work | ECTS | Number of hours |
|---|---|---|---|---|---|---|---|---|---|
| | | Total | Lectures | Lab | Practice/ seminar | Independent work | | | |
| 3 | 6 | 136 | 18 | 42 | 8 | 68 | 0 | 5 | Full-time |
| 4 | 7,8 | 136 | 4 | 10 | 4 | 118 | 0 | 5 | Part-time |

**Competencies**

- Plan and organize automated support of various activities;
- To be able to apply basic scientific and theoretical knowledge for solving practical problem.

**Course goal**

- Assistance in the development of future teacher's professional competence;
- Formation of a holistic view of the role of information technologies in the modern educational environment and pedagogical activity;
- Mastering capabilities of information technologies in solving pedagogical tasks.

**Course outcomes**

After completing this course student will be able to:

- know principles of using modern information technologies in professional activity, and main trends of the ICT technologies development;
- use application software and the Internet for solving typical professional tasks in the methodology of education;
- define methods of using modern information technologies into educational activities;
- choose ICT means for solving practice-oriented and research problems.



## Course content

**1. Information environment of general secondary education**

Education informatization. Information educational environment. Possibilities of contemporary information educational environment. Informational education environment as a means of organizing the information activity of a teacher and a student. Unified information educational environment. The concept of a unified information educational environment (UIEE). Components of the UIEE. Information Republican educational environment. Educational portals.

**2. Information technologies in pedagogue professional activity**

Didactic goals and tasks of using modern information and communication technologies in education. ICT opportunities for the development of creative thinking. Technical means of information and communication technologies used in teaching students. Information tools and technologies that provide the work of multimedia centers in educational institutions.

**3. The main types and essence of study material as the most important component of information pedagogical technologies**

The concept of study material. Communication activity and the essence of information communication in learning process. The teacher role in the effective use of study materials. Principles of the development of study material optimal structure.

**4. Information and education resources for educational purpose: their classification and didactic functions**

The concept of an electronic education resource (EER). Classification of EER. Systematization, description of electronic educational resources. Examination of electronic educational resources environment.

**5. Methods of using information and communication technologies for solving typical professional and methodological problems**

Definition of typical professional and methodical problems. Algorithms for solving typical professional and methodical problems. Use of information technologies, information systems in solving typical professional-methodological problems.

**6. The use of information technology in educational work**

Informatization of extracurricular activities of schoolchildren. Information technology for leisure-time activities of schoolchildren. Students communities networks. Information techniques and technologies providing the work of modern Internet services.

**7. Computer based diagnostic assessment tool in teaching process**

Acquaintance with the diagnostic tools. Planning diagnostic procedures. Determining the students educational abilities with the use of computer pedagogical resources and development of study tasks.

**8. Information technology in pedagogical research.**

Pedagogical monitoring. Databases. Collection and accumulation of data of a child. Analysis and mathematical processing of the accumulated data. Use of MS Office computer technologies for mathematical data processing.

**9. Technological process of the teacher individual activity and his professional development.**

Basic concepts of the individual technological process in pedagogical activity. Principles and methods of information support and technical ensuring a teacher pedagogical individual activity. Modern communication tools reflecting the teachers' achievements, creative contests of pedagogical mastery.

There were developed Theoretical content, Practical content, and Assignment for independent work. The main practical skills students will acquire when implementing laboratory works. Below the content of these assignments are given.



**Table 2. Assignments**

| Name of the practical assignment | Content |
|---|---|
| Information Republican educational environment. Educational portals. | Overview of national educational resources |
| Information tools and technologies that provide the work of multimedia centers in educational institutions | Contemporary multimedia and mass media. Tools of „virtual reality". Interactive whiteboard, its technical and pedagogical features. Preparation of materials for the interactive whiteboard and techniques for using it. Mobile and telecommunication tools used in general secondary education. |
| Principles of the development of study material optimal structure. | Development of optimal study information structure |
| Examination of electronic educational resources | ETR quality assessment: requirements, comprehensive expertise (technical, content, design-ergonomic), evaluation criteria.<br>Forms of interaction with global information environment resources. Open education resources of the world information environment. |
| Use of information technologies, information systems in solving typical professional-methodological problems. | Overview of information technologies and systems. Solving typical professional tasks with the use of information tools. |
| Information techniques and technologies providing the work of modern Internet services. | Technical means and software for modern Internet services |
| Determining the students educational abilities with the use of computer pedagogical resources and development of individual study tasks | Diagnostics of students' educational abilities and development of individual educational tasks |
| Use of MS Office computer technologies for mathematical data processing. | Statistical processing. Modern systems for processing statistical information. Visual presentation of the accumulated data and the results of mathematical analysis and data processing. Graphs and diagrams drawing. |

| | |
|---|---|
| Modern communication tools reflecting the teachers' achievements, creative contests of pedagogical mastery. | Online communities of pedagogues. Overview of websites reflecting the creative achievements of teachers |

## Assignments for independent work

**1. General secondary education information environment**

Study of the main and additional literature on a topic.

To prepare a talk and presentation on educational environment as a part of socio-cultural environment.

**2. Information technologies in pedagogue professional activity**

Study of the main and additional literature on a topic.

To prepare a talk and presentation on new information technologies in education.

**3. The main types of information and the essence of study information as the most important part of information pedagogical technologies**

Study of the main and additional literature on a topic.

To prepare a talk on the features of selection and structuring study information and its presentation for processing with the use of the given information technology.

**4. Information educational resources of educational purpose: their classification and didactic functions**

Study of the main and additional literature on a topic.

To hold an expertise of the given information educational resources.

**5. Methods of using information and communication technologies for solving typical professional and methodic tasks**

Study of the main and additional literature on a topic.

To analyze the experience on solving typical professional and methodic tasks with the use of information and communication technologies.

**6. Using information technologies in educational work**

Study of the main and additional literature on a topic.

To prepare a scenario of an educational event.

**7. Computer diagnostics in teacher activity**

Study of the main and additional literature on a topic.

To develop brief recommendations on using information technologies for a given students group

**8. Information technologies in pedagogical research**

Study of the main and additional literature on a topic.

To prepare a talk and presentation on the features of using one of the statistical methods for processing the results of pedagogical research.

**9. Technological process of the teacher individual activity and his professional development**

Study of the main and additional literature on a topic.

To prepare a talk and presentation on the use of information technologies in the appearances of the contest "Teacher of the year" participants.

In teaching this discipline we will use the following:

- interactive methods (round tables, project method etc);
- implementation of individual practical assignments (business games, individual solution of situational tasks, work in groups);
- distance learning technologies with the assistance of the training portal (eLearning Server).

The students will be provided with electronic presentations of lectures, electronic and printed versions of handouts for practical classes. On full-time classes, students will learn the discipline directly in the computer lab.

The work of leading specialists in the field of pedagogical education, as well as the material and scientific base of the Physics and Mathematics Faculty of the Belarusian State Pedagogical University, allow solving all our tasks and successfully introducing the developed program into the study process.



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Anotacija

**STUDIJŲ PROGRAMOS „INFORMACINĖS ŠVIETIMO TECHNOLOGIJOS", SKIRTOS MATEMATIKOS IR KOMPIUTERIŲ MOKSLO MOKYTOJŲ RENGIMUI, MODERNIZAVIMO YPATUMAI**

Straipsnyje aptariamos būsimų kompiuterių mokslų mokytojų, orientuotų į praktinį mokymą, rengimo problemos. Autoriai pabrėžia svarbius būdus, kaip padidinti būsimų kompiuterių mokslų mokytojų mokymo efektyvumą. Pabrėžiama, kad reikia ne tik formuoti studentų žinias apie šiuolaikinius informacinius resursus, bet ir juos įvaldyti modernios informacinės visuomenės sąlygomis. Naujos socialinės ir ekonominės sąlygos reikalauja naujo dalyko "Informacinės technologijos švietime" turinio. Modeliuojamas ir aptariamas naujas IT specialisto profilis.

***Esminiai žodžiai:*** *inovatyvus švietimas, į praktiką orienyuotas mokymas, studijų programos struktūra, informacinės technologijos, mokytojų rengimas, studijų programa.*