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FEATURES OF TEACHING THE DISCIPLINE «INFORMATION TECHNOLOGIES IN TEACHING PHYSICS» AT THE PEDAGOGICAL UNIVERSITY

The use of information technology in teaching physics is especially relevant at the present time. This article describes the experience of teaching the discipline «Information technologies in teaching physics» for students-future physics teachers at a pedagogical university. The article discusses the features and problems of teaching this discipline in a pedagogical university, describes the effective methods and technologies used in the study of the discipline, ways of enhancing the cognitive activity of students taught by means of information technology. The difficulties and problems arising when using a computer in education are also described, methods for analyzing electronic educational resources are described. The use of electronic educational resources allows to provide positive motivation for learning, improve knowledge control, provide access to various reference systems, electronic libraries and other information resources. While studying the discipline «Information technologies in teaching physics», future physics teachers get acquainted with information technologies, network Internet resources and the possibilities of their use in physics lessons at school. The use of information technology in teaching physics at school increases the motivation of students to learn, and also contributes to an increase in the information culture of students.

Keywords: information technology, physics, pedagogical university, teaching methods of physics.

Introduction

A powerful information explosion characterizes the time in which we live now. The content of general secondary education, which practically took shape in

a different socio-economic era, no longer meets the needs of modern life, focused on constant changes. Yesterday's scientific information is supplemented and revised, and some ideas and hypotheses are discarded. The modern school needs specialists who are ready to work in the changing conditions of our society. One of the areas of innovative projects in school practice is the use of modern information and communication technologies, electronic educational resources in teaching.

Recently, more and more attention is paid to the introduction of achievements in the field of information technology into the traditional education system [1–5]. The computerization of educational institutions contributes to the widespread use of educational electronic resources and Internet technologies in the educational process.

As you know, electronic educational resources include various electronic teaching aids, instrumental and applied programs, as well as Internet resources. Today they are being actively introduced into the practice of schools. This is largely because the corresponding software has appeared which does not require special programming knowledge from a teacher or student.

The emergence of a sufficient number of computers, digital photo and video cameras, interactive whiteboards at school requires the formation of the corresponding competencies in the physics teacher. The latter presuppose not only knowledge of the technical capabilities of the equipment, but also a deep knowledge of the methodological capabilities in application. We also note that it is important to develop practical skills and abilities in working with such equipment [6].

Currently, it is impossible to be a pedagogically competent specialist without studying the vast arsenal of existing pedagogical technologies.

Materials and methods

The teacher implements interactive teaching aids into his practice, and must not only be a confident PC user, but also master the method of designing a lesson using interactive equipment and multimedia resources.

Conducting this discipline answers the questions.

1) When should you use Internet technologies and electronic educational resources (EER) in physics lessons?

2) How can you use Internet technologies and electronic resources in the classroom?

Note that the use of Internet technologies and EER in education is justified only in those cases in which they provide a significant advantage over traditional forms of education.

The use of information technology by a teacher in physics lessons:

- Creation of multimedia presentations of lessons;
- Using a computer to demonstrate videos;

- Use of multimedia physics textbooks;
- Use of computer simulators for organizing knowledge control;
- Preparation of graduates for passing the UNT;
- Execution of a computer physical laboratory experiment;
- Preparation and holding of conferences, competitions;
- Use of the global Internet;
- Organization of individual interactive training for students;
- Organization of research and project activities of students using computer models and virtual laboratories.

An important condition for the effective use of computer training tools is their reliability and simplicity. The teacher should spend a minimum of time mastering the software and be sure that it will not let him down in the lesson. The teacher will be willing to use educational electronic resources if they allow him to achieve, with less effort and in less time, the same learning effect as by traditional means, or at the same time – to achieve a greater learning effect.

The use of educational electronic resources should not be predominant, but play an auxiliary role, making up only a part of the lesson. At the same time, the selection of educational electronic resources should be determined by the general lesson plan and correspond to its target setting. According to sanitary standards, the use of an interactive whiteboard in one lesson is 20 minutes.

Teachers need to remember about the optimal frequency of using computer tools in the lesson, diversify the forms of their use, and also need to be prepared for the fact that in the near future there will be a loss of the novelty factor in students' perception of the computer and EER.

But there are also some difficulties and problems that arise when using a computer in education.

First, it is the harmful effect of a computer on the health of schoolchildren, primarily on vision. This means that when creating computer software, prescribing the methodology for its application, it is necessary to minimize the time a student is directly working with a computer. It is worth using a computer only if it really allows you to achieve a new effect in comparison with traditional technologies.

Results and discussion

In order to familiarize future physics teachers with information technologies, and the possibilities of their use in physics lessons at school, the discipline «Information technologies in teaching physics» was introduced for students of the specialty Physics at Pavlodar State Pedagogical University.

This discipline is included in the curricula of pedagogical specialties based on the catalog of elective disciplines. Accordingly, there are no requirements for the mandatory minimum content of the discipline in the SES. Based on the study of

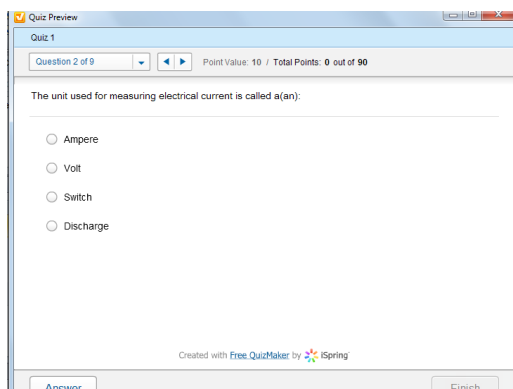
scientific and methodological literature [7–10], modern requirements for a future teacher in the field of innovative educational technologies and taking into account the specifics of training students in the specialty «Physics», we have developed a mandatory minimum content for discipline «Information technologies in teaching physics», a work program for the discipline and training programs (syllabus) for students have been drawn up.

The discipline is designed for 60 academic hours and is studied by future physics teachers during the seventh semester. We consider this arrangement of the discipline in the curriculum to be quite successful, since students are acquainted with modern pedagogical technologies before the active pedagogical practice of the fourth year. This allows them to use the elements of the considered technologies in pedagogical practice in the preparation and conduct of classes. Laboratory and practical classes in the discipline are held in a computer class and in classrooms with an interactive whiteboard.

The use of computer tools in the educational process contributes to an increase in the pace of learning the material, but this increase cannot be large, since the bandwidth of the brain has a certain limit. Therefore, it would be a mistake to think that the use of computer tools can significantly change the timing of schooling. Moreover, often the use of Internet technologies or EER takes more time, since it allows the teacher to draw the attention of students to those important issues that could not be studied without them.

When compiling the tests, the following programs were used.

a) For summative assessment, the QuizMaker program. In this program, you can write multiple-choice tests, one answer, or you can write the answer. You can insert a picture and formulas in physics into the test question (Figure 1).



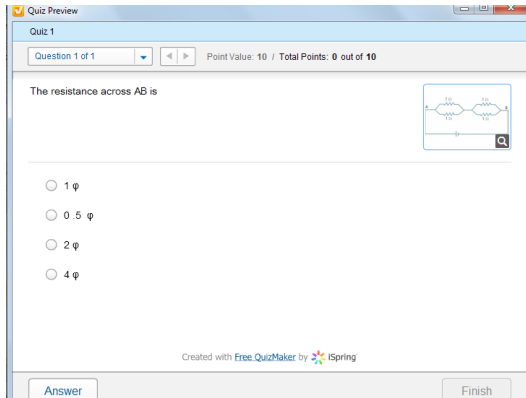


Figure 1 – The QuizMaker program

b) The Kahoot program was used for formative assessment of students' knowledge. This survey was usually carried out at the end of the lesson. For a survey, 5 minutes is enough. The test is not graded (Figure 2).

Kahoot is a relatively new service for creating online quizzes, tests and surveys. Students can answer teacher-created tests from tablets, laptops, smartphones, that is, from any device with access to the Internet.

The tasks created in Kahoot allow you to include photos and even video clips. The pace of execution of quizzes, tests is regulated by introducing a time limit for each question.

The teacher can enter points for answering the questions asked: for correct answers and for speed. The scoreboard is displayed on the monitor of the teacher's computer.

Using this service can be a good way to get original feedback from students.

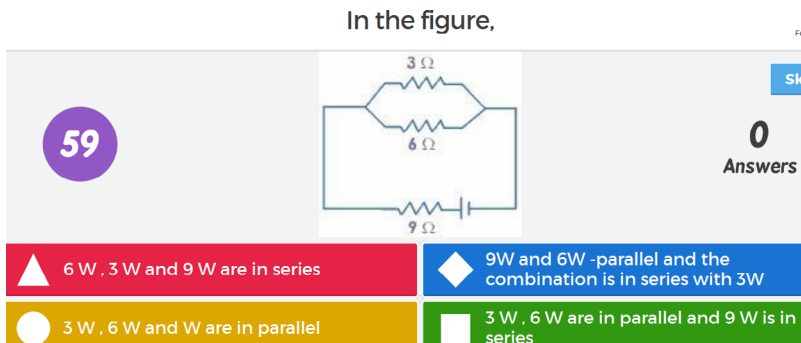


Figure 2 – The Kahoot program

Also in the lesson were used video clips from various channels on the Internet: Video with Russian subtitles, video with English subtitles

Channel MinutePhysics. It is a channel in Youtube, where 1-minute long videos are presented on different subjects in physics (<https://www.youtube.com/channel/UCUHW94eEFW7hkUMVaZz4eDg>) (Figure 3).

Video from Khan Academy Physics channel

Khan Academy is a non-profit organization that aims to make world-class quality education available anywhere, anytime and for everyone. At the moment, the Academy offers lessons in mathematics, physics, chemistry, biology, cosmology and astrophysics, medicine, world history, art history, music, programming in JavaScript and HTML, as well as other topics and subjects. The range of lessons is constantly expanding, supplemented and corrected. The system of lessons is built on the principle «from simple to complex»; videos are grouped into thematic blocks. The duration of the videos is from 2 to 25 minutes. (<https://www.khanacademy.org/science/physics>)

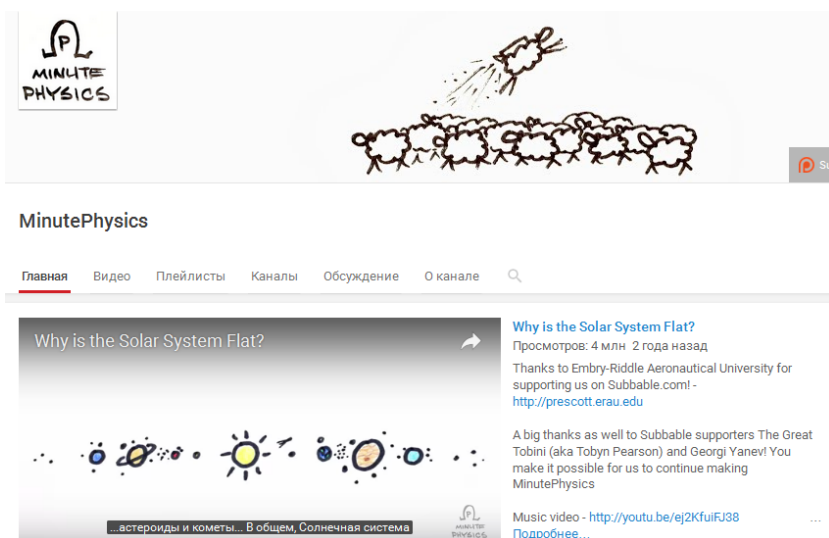


Figure 3 – Channel MinutePhysics

c) Virtual online physics laboratories

The use of information and communication technologies in the educational process increases the effectiveness of the perception of the material, contributes to

an increase in students' interest in studying the subject, expands the possibilities of demonstrating experiences through the use of virtual images [10].

One of the sites with virtual laboratories PhET Interactive Simulations (<https://phet.colorado.edu/en/simulations/category/new>) (Figure 4).

Also at the lessons of the discipline, the EER «Principles of Electronics» was used, which includes 18 laboratory works (Figure 5).

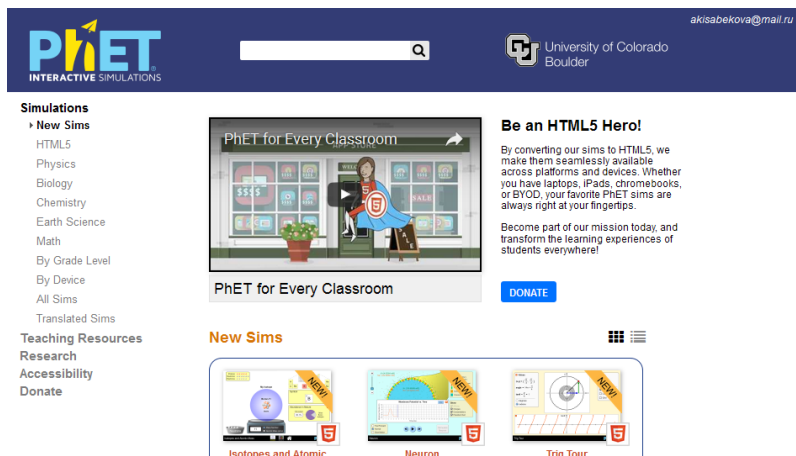


Figure 4 – PhET Interactive Simulations

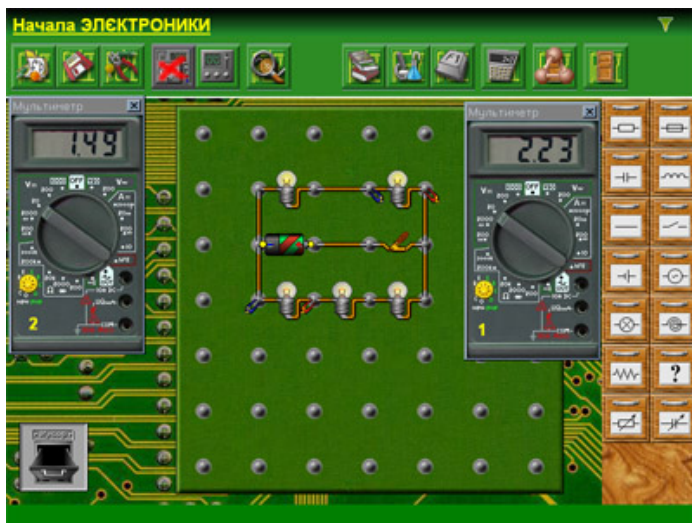


Figure 5 – EER «Principles of Electronics»

Beginnings of Electronics – a training system for university students in the course of electricity. The training system is implemented as a multimedia application running in the WindowsXX operating system, it is an electronic constructor in which the student can «assemble» various electrical circuits and observe their steady state mode by connecting various sources of direct or alternating current.

One of the forms of testing students' readiness to work as a physics teacher is teaching practice. In the course of its implementation, students test the theoretical and practical knowledge, abilities and skills obtained within the walls of the institute.

At the department, under the guidance of teachers, students are engaged in research and educational research work in various areas of teaching methods of physics. As part of this activity in the direction of «Information technology in teaching physics», students prepare abstracts for participation in conferences, develop projects, and write theses.

Conclusion

Therefore, on the basis of the foregoing, it can be concluded that the use of information technologies not only significantly increases the motivation of students to learn, but also contributes to the development of their ability to search for information on the educational Internet, as well as to classify, compare and critically evaluate the information received. In general, it enhances the information culture of students and helps to turn learning into a creative process.

It is impossible to completely abandon a full-scale experiment and reduce everything to computer simulations and computer modeling. In our opinion, it is necessary to compare constantly real and computer experiments, to show the limitations of computer models on the one hand, and their capabilities and some advantages on the other.

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ПЕДАГОГИКАЛЫҚ ЖОО-ДА «ФИЗИКАНЫ ОҚЫТУДАҒЫ АҚПАРАТТЫҚ ТЕХНОЛОГИЯЛАР» ПӘНІН ОҚЫТУ ЕРЕКШЕЛІКТЕРІ

Физиканы оқытуда ақпараттық технологияларды қолдану қазіргі уақытта өте өзекті болып табылады. Бұл мақалада педагогикалық жоғары оқу орнында болашақ физика мұғалімдері-студенттерге арналған «Физиканы оқытудағы ақпараттық технологиялар» пәнін оқыту тәжірибесі сипатталған. Мақалада осы пәнді педагогикалық университетте оқытудың ерекшеліктері мен мәселелері қарастырылады, пәнді оқытуда қолданылатын тиімді әдістер мен технологиялар, ақпараттық технологиялар құралдарымен оқытылатын студенттердің танымдық қызметін белсендіру тәсілдері сипатталған. Сондай-ақ, білім беруде компьютерді пайдалану кезінде туындайтын қиындықтар мен проблемалар сипатталған, электронды білім беру қордарын талдау әдістері сипатталған. Электрондық білім беру ресурстарын пайдалану оқытудың оң жаққа ынталандыру қамтамасыз етуге, білімді бақылауды жетілдіруге, түрлі анықтамалық жүйелерге, электрондық кітапханаларға және басқа да ақпараттық жүйелерге қол жеткізуді қамтамасыз етуге мүмкіндік береді. «Физиканы оқытудағы ақпараттық технологиялар» пәнін оқу кезінде болашақ физика мұғалімдері ақпараттық технологиялармен, желілік интернет-ресурстармен және оларды мектептегі физика сабақтарында пайдалану мүмкіндіктерімен танысады. Мектепте физика пәнін оқытуда ақпараттық технологияларды қолдану оқушылардың оқуға деген ынтасын арттырады, сонымен қатар оқушылардың ақпараттық мәдениетін арттыруға ықпал етеді.

Кілтті сөздер: ақпараттық технологиялар, физика, педагогикалық ЖОО, физиканы оқыту әдістемесі.

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ОСОБЕННОСТИ ПРЕПОДАВАНИЯ ДИСЦИПЛИНЫ «ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ В ПРЕПОДАВАНИИ ФИЗИКИ» В ПЕДАГОГИЧЕСКОМ ВУЗЕ

Применение информационных технологий при преподавании физики является особенно актуальным в настоящее время. В данной статье описан опыт преподавания дисциплины «Информационные технологии в преподавании физики» для студентов-будущих учителей физики в педагогическом вузе. В статье рассматриваются особенности и проблемы преподавания данной дисциплины в педагогическом вузе, описаны эффективные методы и технологии, применяемые при изучении дисциплины, способы активизации познавательной деятельности обучающихся, обучаемых средствами информационных технологий. Также описаны трудности и проблемы, возникающие при использовании компьютера в образовании, описаны методы анализа электронных образовательных ресурсов. Применение электронных образовательных ресурсов позволяет обеспечить положительную мотивацию обучения, усовершенствовать контроль знания, обеспечить доступ к различным справочным системам, электронным библиотекам и другим информационным ресурсам. При изучении дисциплины «Информационные технологии в преподавании физики» будущие учителя физики знакомятся с информационными технологиями, сетевыми интернет-ресурсами и возможностями их использования на уроках физики в школе. Использование информационных технологий при преподавании физики в школе повышает мотивацию учащихся к обучению, а также способствует повышению информационной культуры обучающихся.

Ключевые слова: информационные технологии, физика, педагогический вуз, методика преподавания физики.

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