NEW APPROACH TEACHING CHEMISTRY

Yodgorov Bakhtiyor Orziqulovich

Senior lecturer, Tashkent Regional Chirchik State Pedagogical Institute

Abstract. Traditional learning tools and control of training of bachelors should be updated through the introduction of information technologies. There are the following information technologies in educational process: electronic educational-methodical complexes, electronic textbooks, video lectures, educational films; electronic laboratory and practical work, didactic tests, electronic directories and others. The use of information technologies in teaching a number of fundamental disciplines such as chemistry is very important. The use of new learning technologies in comparison with traditional has advantages.

There are also some features of the application of information technology in teaching physical chemistry. The paper presents a detailed analysis of the use of information technologies. It allowed the authors to conclude that the update of traditional learning tools in teaching chemistry course covers the entire educational process.

Keywords: information technology; chemistry; electronic laboratory work; electronic educational-methodical complexes; electronic tests; educational films; video lectures, electronic textbooks.

НОВЫЙ ПОДХОД К ОБУЧЕНИЮ ХИМИИ

Ёдгоров Бахтиёр Орзикулович

Старший преподаватель, Ташкентский областной Чирчикский государственный педагогический институт

Аннотация. Традиционные средства обучения и контроля подготовки бакалавров должны быть обновлены за счет внедрения информационных технологий. В учебном процессе используются следующие информационные технологии: электронные учебно-методические комплексы, электронные

учебники, видеолекции, учебные фильмы; электронные лабораторные и практические работы, дидактические тесты, электронные справочники и др. Очень важно использование информационных технологий в преподавании ряда фундаментальных дисциплин, таких как химия. Использование новых технологий обучения по сравнению с традиционными имеет преимущества.

Также есть некоторые особенности применения информационных технологий в обучении физической химии. В статье представлен подробный анализ использования информационных технологий. Это позволило авторам сделать вывод, что обновление традиционных средств обучения в преподавании курса химии охватывает весь учебный процесс.

Ключевые слова: информационные технологии; химия; электронные лабораторные работы; электронные учебно-методические комплексы; электронные тесты; обучающие фильмы; видеолекции, электронные учебники.

Today, there is an acute issue of updating traditional teaching methods, through the use of information technology. This is especially relevant in the process of training future teachers. However, in the process of teaching a number of fundamental disciplines, including chemistry, such innovations encounter a number of difficulties. Among them there is the lack of development of the relevant teaching materials, and the unpreparedness of teachers for the widespread use of new teaching methods, instead of traditional ones, and high mathematical complexity, requiring appropriate software and graphic presentation of the material. But, despite these and other difficulties, attempts are being made to introduce information technologies into the process of teaching the discipline "Chemistry". This discipline is quite difficult to study, requires a large amount of independent work of students, therefore the development of modern computer teaching methods seems to be especially relevant.

Information technologies used in the learning process can be divided into several types. Among them there are electronic textbooks, lectures, notes, electronic laboratory and practical work, simulators, encyclopedia reference books, testing technologies.

Let's consider how these technologies are applied in the process of teaching chemistry. NG Gureev [1,2] notes that an electronic textbook on chemistry fulfills new roles and functions and it can simultaneously be a simulator and a controller in the course of independent work, and, therefore, significantly increases the effectiveness of training.

The authors of [1] have accumulated a fairly large amount of information and methodological material using computer technologies and have begun the development of an electronic textbook. HER. Goncharenko [2], considering the problem of innovations in the process of teaching chemistry, also notes the huge role of computer technology. In this regard, a didactic complex of information support for the discipline was created for students studying the discipline "Chemistry". It includes a database necessary for completing two homework assignments and five laboratory works in a computer workshop, as well as a set of other didactic tools and methodological materials that ensure the educational process. The didactic complex also includes: a work program of the discipline, a lecture course outline, a set of tasks with examples of solutions for each module, control questions and tasks for sections of the lecture course with elements of scientific and technical creativity, electronic versions of guidelines for laboratory work. Thus, working in the laboratory, students have all the necessary educational material. T.L. Anisova [3,4] suggests using MS Excel to solve problems in chemistry. The paper shows an example of solving a problem in chemical kinetics. It should be noted that the entire process of solving the problem is carried out by the students themselves, i.e. the program acts only as a tool, and ready-made forms and already developed information environments are not offered. NV Zhukova [5,6] reports on the development of an electronic test simulator in chemistry, containing six meaningful blocks: "Aggregate states", "Basic laws of thermodynamics", "Thermodynamic equilibrium", "Chemical kinetics", "Non-electrolyte solutions", "Solutions of electrolytes". Each block consists of theoretical part, revealing the main issues of the block; simulator tasks with a detailed solution; questions-simulators, which are test tasks with feedback; a control test designed to monitor students' knowledge.

In addition, the student has all the reference material necessary for solving tasks. G.M. Kurunin [7] and G.M. Bondareva [8] write about the use of electronic testing in teaching chemistry: the use of test items in combination with other types of testing is an effective tool that stimulates the preparation of students for each lesson and increases motivation for the subject under study.

Thus, at present, in the process of teaching chemistry, various electronic teaching aids are quite actively used and attempts are being made to introduce electronic practical and laboratory works.

At the Department of Chemistry of the Chirchik State Pedagogical Institute, information technologies are also being introduced into the educational process. For the successful development of the discipline "Chemistry", elements of electronic educational and methodological complexes (EEEMC) have been developed for students enrolled in undergraduate programs in chemistry and biology. So for specialties: "Chemistry" [9]. When constructing the complexes, a multi-level modular principle was applied, because it is known that a well-structured complex not only provides quick and convenient access to educational materials, but also helps to plan the development of the course and contributes to more rhythmic and efficient student work during the semester.

All lecture material in electronic form is included the educational and methodological complex of the discipline and is issued to students, which contributes to the successful development of the course.

The lecture course is conducted using electronic presentations shown on a projector. This allows:

- to visualize mathematical formulas, use a large and clear font, which makes it easier for students to understand and speeds up the process (compared to using a traditional board);
- show portraits of scientists, accompanying it with a short story, which increases interest in classes;
- show pictures and graphics with animation - this improves perception and memorization of addictions, promotes concentration of students' attention.

Video lectures have been developed for some sections of the course. In addition, to increase the motivation to study chemistry, a video film "The Emergence of l Chemistry" was created, which in a vivid and entertaining form tells about the period of the formation of chemical science, preceding the emergence of chemistry. The prerequisites for the emergence of chemistry, the features of this process are shown, it is told about the outstanding scientists who contributed to the formation of this science and the main quantitative laws that formed its basis[10,11,12].

When working in practical classes, special presentations are used: they are composed in such a way that the formulas necessary for solving problems appear gradually, at a speed set by the teacher. This contributes to the flow
dialogue with the student, gives the student time to think about the problem, and not write off everything from the screen.

To solve problems requiring long-term calculations, special calculation programs have been created. These programs are used:

- for calculating changes in the extensive properties of the system due to the occurrence of a gas reaction in it;
- to determine the molar excess isobaric heat capacity of the solution;
- to determine the partial molar isobaric heat capacities of the components of a binary solution;
- to determine the molar volumes of mixing during the formation of binary solutions;
- to determine the most probable chemical reaction in a multicomponent gas system;
- for calculating the equilibrium composition of the gas system formed during the cracking of hydrocarbons;
- for calculating the equilibrium composition of an ideal gas system when several reactions occur in it;
- to calculate changes in the extensive properties of a system when a heterogeneous reaction occurs in it.

These Excel-based programs allow the student to make calculations much faster than manually. In addition, in the programs, before directly the calculations, all the necessary formulas are given, there are explanations of the symbols, in these formulas included, the approximate graphical dependencies of the studied properties are shown. Such a repetition of theoretical material undoubtedly contributes to a better assimilation of it[13,14,].

The use of these programs is possible both in the staff computer hall of the department and on a home staff computer.

For independent work of students when doing homework and preparing for intermediate control, there are teaching aids with detailed explanations for solving problems in chemistry [15].

The use of information technology in laboratory studies includes entrance computer testing and electronic laboratory work, which are carried out along with experimental laboratory work.

Input computer testing (remove repetition before laboratory work) allows you to assess the student's readiness to perform laboratory work. Currently, the department uses MyTestX for testing - a system of programs (student testing program, test editor and results journal) for creating and conducting computer testing, collecting and analyzing results, giving marks according to the scale indicated in the test. The tests compiled in this program for the disciplines of the department are based on different types of tasks: single or multiple choice, establishing the order; establishing compliance; an indication of the truth or falsity of the statements given[16,17,18,19,20].

Electronic laboratory work has several advantages over experimental:

1. Since they are not directly related to reagents, they can simulate the work with substances that cannot be used in a student's workshop due to safety precautions, for example, use methanol, benzene, etc.

2. Sometimes electronic laboratory work simulates the use of high-temperature devices, which also cannot be implemented in a student laboratory workshop.

3. Electronic labs are often based on data that goes far beyond the time allotted for lab work and equipment that is not available in the lab.

Almost the entire course of chemistry is covered by electronic laboratory work. There are works on the following topics:

- plotting the fusibility diagram for various systems;
- calculation of changes in the extensive properties of the system due to the occurrence of a gas reaction in it (homogeneous and heterogeneous);
- determination of the partial molar isobaric heat capacities of the components of a binary solution;
- determination of the molar volumes of mixing during the formation of binary solutions;
- determination of the molar excess isobaric heat capacity of the solution;
-determination of the most probable chemical reaction in a multicomponent gas system;
- calculation of the equilibrium composition of the gas system formed during the cracking of hydrocarbons;
- calculation of the equilibrium composition of an ideal gas system when several reactions occur in it;
- construction and analysis of boiling diagrams of binary systems;
- determination of the rates of chemical reactions from the kinetic curve;
- determination of partial orders of the reaction by the integral method;
- determination of partial orders of reaction by the Ostwald-Noyes method;
- determination of partial orders of the reaction by the differential method;
- calculation of the activation energy.

Methodological instructions for such works are available in paper and electronic versions, some works are combined into workshops [21,22,23,24,25,26,27]. To test the knowledge of students as part of intermediate control -differential credit, it is also convenient to use the developed computer tests in chemistry.

Thus, in the process of teaching the discipline "Chemistry", the use of information technologies at all stages of training is implemented. These are electronic

presentations at lectures and practical classes, and special calculation programs for solving problems, and electronic laboratory work, and computer tests before laboratory work and for intermediate control, and methodological and reference materials in electronic form. All these modern forms of education are organically combined with traditional ones (experimental laboratory work, traditional forms of testing, etc.). All this undoubtedly contributes to the successful mastering of the discipline by future engineers and the creation of a solid foundation for their study of special subjects.

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