TEACHING CHEMISTRY COMPUTER SOFTWARE TO STUDENTS OF CHEMISTRY IN PEDAGOGICAL HIGHER EDUCATION INSTITUTIONS

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ABSTRACT

The use of modern computer software in teaching chemistry creates the basis for increasing students' interest in chemistry, transferring knowledge and consolidating knowledge. Chemical computer software is a program used to perform calculations of complex chemical equations and operations, the structure of chemicals, their identification and the display of the parameters of various substances.

Keywords: Pedagogy, analysis, synthesis, education, technology, technical means, ChemDraw, Isis/Draw, ChemBio-Draw, HyperChem, Gaussian, Chemofis, Crocodile Chemistry.

INTRODUCTION

Resolution of the President of the Republic of Uzbekistan dated August 12, 2020 № PP-4805 "On measures to improve the quality of continuing education and scientific efficiency in the field of chemistry and biology" created opportunities for major changes in the development of science and training of highly qualified personnel. One of the priorities of the State Program "Year of Science, Enlightenment and Digital Economy" - *ensuring an effective educational process in the field of chemistry and biology in higher education, achieving the integration of science and industry, undergraduate internships under the guidance of leading experts in the field, teaching students to use modern laboratory and to create conditions for closer acquaintance with production processes, to promote the implementation of the results of scientific work and to establish cooperation in the commercialization of scientific developments*[1]. Implementation of the set tasks, IT Park was established in Tashkent in 2019, its branches were established in regional centers in 2020 [2].

The main purpose of the IT ((pronounced ay-ti, abbreviation for information technology in English). Information technology is the process of searching, collecting, storing, processing, presenting, disseminating data, and the implementation of similar processes and methods.)

Park is to provide talented students, students and researchers with computer literacy, programming, WEB design, graphic design, mobile robotics, mobile applications in science, e-sports, English and other training courses, as well as the rapid development of digital economy

and entrepreneurship, serves to increase the production and export of software products, increase the number of educated young people in the field of information and communication technologies.

The concept of higher education in the Republic of Uzbekistan defines the duties of a specialist as follows:… "A specialist, regardless of their field of activity, must be able to work in creative teams, trained in management and marketing, have a clear idea of economic, social and cultural aspects of new technologies" . These ideas apply directly to educators as well. Because the radical changes taking place in our society, our entry into market relations require teachers to be aware not only of professional knowledge, but also of economic, legal, technical knowledge.

One of the main qualities of modern educators is love of their profession, devotion to it and ideological conviction.

Yusuf Khos Hajib, the great scholar of the pedagogy of the peoples of the East, through his work "Kutadg'u bilik" in the importance, definition and description of science, enlightenment, encourages people to constantly acquire knowledge, to study knowledge. All good deeds in the world are based on knowledge and enlightenment, the darkness of ignorance is written due to the enlightenment of knowledge, the mind is enlightened, and light is spread in the world. He stressed that every sane person should be aware of the affairs of the world, for this he should constantly acquire knowledge and strive for enlightenment[3].

In the early stages of education, the educator makes more use of *analysis-synthesis*. *Analysis* is the breaking down of things and events into components. In the process of *synthesis,* students combine the elements of individual parts of events and events into a whole. Through methods such as synthesis, analysis, comparison, induction, students have the opportunity to form an understanding of themselves.

The analysis of the works of Eastern encyclopedic scholars, using modern terminology, makes it possible to determine the principles and teaching methods of the authors of these works in accordance with the general laws of knowledge. The teaching methods used by all encyclopedic scholars can be divided into several groups. These are: demonstrative experimental methods (Ibn Sina), question-and-answer ways of expressing knowledge (Abu Rayhan Beruni, al-Khwarizmi), methods of formation of skills and abilities, methods of testing knowledge (Farobi, al-Kharizmi), etc. It is noteworthy that all of these scholars aimed to enhance their learning activities and develop logical thinking in them.

What are the current requirements for the teaching process, which increase the interest of students in the lesson, enrich it with elements of innovation? Modern education requires not only the mastery of the knowledge acquired by mankind, but also the acquaintance with the problems which society now has to solve and solve. Such issues may include the assimilation of the world's wealth, the use of the world's most advanced technologies, the conversion of deserts into fertile lands and orchards, the intensification of agriculture, and so on.

Educational technologies have always been informative because they involve the storage, transmission, and delivery of a wide variety of information to users. With the advent of computer technology and communication tools, learning technologies have changed radically. The implementation of information technology in the educational process requires the following:[4].

        - computers and communication tools as technical means of education;

- systematic and practical software suitable for the organization of the educational process;
- appropriate methodological developments for the introduction of new teaching aids in the educational process.

From the point of view of the education system, the following problems that arise with the introduction of information technology are important:
- technical problems - these determine the requirements for electronic computing and microprocessor technology used in the education system, the features of their practical application;
- software problems - these determine the content and types of software for use in the education system, the content and features of their application;
- Problems of preparation - these are related to the ability of teachers and students to use information and communication technologies, including computer technology.

Today, the main direction in the informatization of education is the creation of pedagogical software in various disciplines. However, pedagogical software tools based on existing and developing computer technology can lead to significant shifts in terms of teaching as education. One of the reasons for this is that computer technology has begun to be introduced in the traditionally organized learning process. The introduction of computer and information technologies in the educational process is important because it has its own essence in the form of a new generation of educational tools and the latest types of education. In addition to traditional teaching methods, the educational process has included e-learning products that incorporate all multimedia systems that are considered teaching aids. Educational-methodical electronic products have a great opportunity to prepare students on the topics specified in the program on the basis of the information included in them, to study independently after class[5].

The basis of chemical computer tools are programs used to perform complex calculations, operations and facilitate the appearance of objects, programs used in the implementation of substance identification and combining the parameters of various substances ChemDraw, Isis / Draw, ChemBio-Draw, HyperChem, Gaussian, Chemofis and Crocodile Chemistry is used. Software designed to work with research equipment (NMR, IR spectrometers, illuminating and scanning electron microscopes, chromatographs, chromatomass spectrometers, etc.) is also a specialized program[6.7.8].

One such computer software tool is Crocodile Chemistry, which is the creation of a comprehensive simulated chemical laboratory to safely and easily model experiments and reactions. Pull out chemicals, equipment, and glassware and combine them the way you want, selecting quantity and concentration, mixing chemicals, and visualizing mechanisms using 3D animations to create experimental data analysis with precise modeling of reactions.

The ChemOffice chemical software suite helps chemistry students and researchers conducting research in chemistry to identify and focus on many routine processes. In the program, the modules turn the computer into a workstation for designing and working with databases and chemical documents. The new version of ChemOffice Ultra includes ChemDraw Ultra, Chem3D Ultra, E-Notebook Ultra, ChemFinder, CombiChem, Inventory, BioAssay and The Merck Index. ChemDraw / Excel and ChemFinder / Word modules are used to integrate with Microsoft Office.

Using the data of the structure, you can estimate the spectrum of the substance and visualize the volumetric models of molecules and orbitals using the MOPAC module. The ChemDraw and Chem3D plugins allow you to publish online.

Researchers can record their ideas and share information with colleagues using the natural language of chemical structures and models. While working in the laboratory, researchers can record the results of experiments, organize the storage of chemical data, documents and information using an electronic laboratory journal E-notebook.

The Gaussian program includes a set of software for calculating the structure and properties of molecular systems in this gas-phase and condensed state, including computational chemistry, quantum chemistry, and various methods of molecular modeling. It includes many methods for calculating the structure and properties of molecules. The program also allows you to create files that can be used by many programs to visualize molecular systems. By studying the GaussView-program interface, it is possible to develop a graphical design of chemical structures. The GaussView program is a graphical editor for the Gauss program that makes it very easy to create a startup structure and input file for the Gauss program, and provides intermediate and final calculation results. GaussView (GV) is a collection of routine works used in conjunction with the main. This allows a graphical representation of molecular structures to be obtained. Also calculate the binding energy of molecular structures using the Gaussian program; it is possible to analyze the results of the work performed. In GaussView, the creation of a molecule is done in two ways:

- by adding atoms in series;
- by sequentially adding atoms, cyclic and radical fragments.

The second method is technically convenient and superior. This is explained by the fact that the cycles and radical fragments included in the database of the Gauss-View program have a geometric structure close to the optimal structure and lead to a sharp reduction in the calculation time of the optimization of the geometric parameters of the molecule. This situation is manifested by an increase in the size of the molecular system under study.

The Hyperchem program is a program designed for molecular modeling and quantum chemical calculations. Molecular design and visualization of data included and calculated in Hyperchem, empirical (molecular mechanics method), semi-empirical and quantum chemistry method and other computational methods. Hyperchem is an effective learning tool for performing quantum chemical calculations due to convenient and visual molecular modeling and visualization of the geometric and electronic structure properties of molecules.

The ChemBioDraw program is a set of state-of-the-art scientific and practical applications for researchers to draw the structure of chemicals and analyze their properties, along with drawing biological structural paths. ChemBioDraw provides advanced chemical tools and complete analysis and synthesis for drawing chemical structures, preparing quality graphics for publication, and input for simulation and other applications that require electronic description of molecules and reactions. ChemBioDraw also offers a drawing tool for biological pathways. It includes the common pathway of elements (membranes, DNA, enzymes, receptors, etc.), as well as the ability to import other elements.

The Isis / Draw program has the ability to demonstrate huge and inconvenient formulas of organic chemistry and biochemistry, as well as their cycle drawing, single, double and triple bonding in substances.

ChemDraw Software - ChemDraw, one of the components of the ChemOffice integrated software suite, is designed for two-dimensional depiction of molecular structures and belongs to what is called a two-dimensional chemical editor. This program allows you to reflect molecular structures of any complexity in a plane, write reaction equations, name substances, molecules and then convert them into three-dimensional Chem3D models.

The use of computer tools in the teaching of chemistry creates a basis for increasing students' interest in the subject, imparting knowledge and strengthening knowledge. The use of teaching aids on a regular basis for each topic is effective. Continuous application of the same order and repetitive methods loses the stability of the quality of education. The variety of teaching methods and visual aids stabilizes the teacher-student relationship.

CONCLUSION

In addition, researchers conducting research in various fields of chemistry will be able to accurately model the mixing and reaction processes of chemicals, estimate the spectrum of matter, visualize volumetric models of molecules and orbitals, including the development of various methods of computational chemistry, quantum chemistry and molecular modeling, graphical construction of chemical structures, convenient and visual molecular modeling and visualization of the geometric and electronic structure properties of molecules, drawing chemical structures, it will be possible to prepare high-quality graphics for the publication and to demonstrate the simulation and electronic description of molecules and reactions, as well as the huge and inconvenient formulas of organic chemistry and biochemistry, as well as to draw their cycles, multiple connections in substances.

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