Information technologies in teaching chemistry to future specialists in automated engineering

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Abstract. The article reveals the problem of using information technologies in the process of teaching chemistry to future specialists in automated engineering. The modern level of development of automated engineering requires highly educated specialists, creative people capable of free thinking. This sets a task for higher education to develop methods for the development of such competitive personality. In recent decades this task has been successfully solved through the development and implementation of various information technologies in the educational process.

1. Introduction

Only in the last decade new information technologies have been used everywhere - the Internet, mobile communications, digital technologies. At the same time the educational standard being developed should be a response to the challenge of the modern global continuously changing world.

However, using computer technologies in the learning process at present including chemistry is the exception rather than the rule. In addition, it must be admitted there has been a decrease in students’ interest in natural sciences in general and in chemistry in particular in recent years. It is one of the problems in education. The reasons for the negative changes in teaching chemistry in recent years are connected with the complexity of the program material and the reduction of study time, as well as the insufficient provision of the learning process with special equipment. At the present stage of the country’s development education is being modernized. Within it teachers are actively searching for new approaches, means and methods of teaching. The purpose of pedagogical activities is focused on improving the quality of education through the introduction and integration of modern educational technologies. Meanwhile, the information technologies give the leading place.

With regard to the teaching of chemistry to future specialists in automated engineering there is an increase in motivation due to the use of information technologies. There is also an increase in the level of individualization of learning and the possibility of organizing operational control over the assimilation of knowledge. It is known however that at this stage computer technologies in the teaching of chemistry at the university are used very rarely. It has the reason of both objective and subjective nature. Such educators as V.P. Bespalko, A.A. Verbitskiy, P.Ya. Galperin, B.S. Gershunskiy, V.V. Davydov, L.I. Doliner, M.I. Zheldak, V.V. Lapteva, V.S. Lednyev, Ye.I. Mashbits, P.I. Obraztsov, I.V.
Robert, B.Ye. Starichenko, N.F. Talyzina, V.F. Sholokhovich and many other researchers consider information technologies in the learning process in various aspects. However, the analysis of psychological and pedagogical literature and educational practice shows the contradiction. It is between the recognition of the need to use information technologies in the process of teaching chemistry and the current insufficient methodological development of this issue in learning. This implies the goal of the study. It is to identify the pedagogical conditions that ensure the effective use of information technologies in the process of teaching chemistry to future specialists in automated engineering.

The following hypothesis is put forward at the beginning of the study. The use of information technologies in the process of teaching chemistry to future specialists in automated engineering will be effective if the following pedagogical conditions are complied with:

- creating a positive motivation of subjects of learning to use information technologies;
- using multi-level tasks for students (individualization of training);
- developing self-control among future specialists in automated engineering in the process of teaching chemistry.

2. Materials and methods

The methodological basis of the study is based on the following theories and approaches. They are the psychological theory of activities (L. Vygotsky, A. N. Leontyev, S. L. Rubinstein, and others); the system approach (V.G. Afanasyev, I.V. Blauber, V.P. Bespalko, etc.); the integrative developmental approach (L.A. Shipilina and others); the personality-oriented approach (E.F. Zeer, B.F. Lomov, V.V. Serikov; I.S. Yakimanskaya and others); the theory of society informatization (E.P. Velikhov, B.S. Gershunsky, A.M. Dovgyallo, A.P. Ershov, etc.); the theory of computer technologies (Yu.S. Branovsky, A.L. Vagramenko, A.A. Kuznetsov, M.P. Lachik and others); the theory and methodology of pedagogical studies (V.I. Andreev, M.I. Grabar, A.G. Gostev, P.M. Zhuchek, etc.) The problems of creating computer-based training programs, classifying software for educational purposes, pedagogical requirements for instrumental funds were considered by Sh.M. Kalanova, V.P. Linkova, G.A. Lisiev, S.V. Panyukova, M.I. Potev, E.G. and others. The study dealt with the works of the classics of psychology and pedagogy B.G. Ananyeva, L.S. Vygotsky, Ya.A. Komensky, K.D. Ushinsky and others.

The subject, hypothesis and objectives of the study determined the choice of a set of research methods. They are the theoretical analysis of the problem based on the study of psychological, pedagogical and methodological literature; comprehensive diagnostics using questionnaires, testing; observation; experiment; description; analysis; generalization and systematization of the results of the experiment; methods of computer data processing and visual presentation of the results.

3. Results and Discussion

Modern educational standards give a teacher a certain freedom in choosing subjects and placing accents in the presentation of the discipline taught to them. The experience of using computer technologies in teaching chemistry to future specialists in automated engineering allows one to conclude the following. To obtain a high learning effect it is important to use them systematically, both at the stage of studying the material and at the stage of operational control over the assimilation of knowledge. And this also requires a wide range of pedagogical software means[1,2].

Pedagogical software allows to visualize such processes providing the possibility of multiple repetitions and advances in learning at the speed that is favorable for each student to understand a particular educational material.

Pedagogical software being a part of educational software provides an opportunity to be introduced to modern methods of working with information, to intellectualize educational activities. The use of pedagogical software data in teaching chemistry makes it possible

- to increase the motivation of teaching and learning;
- to individualize and differentiate the learning process due to the possibility of studying with an individual speed of learning;
- to carry out control with feedback with diagnosing errors and evaluating the results of educational
activities;
- to carry out self-control and self-correction;
- to carry out training in the process of mastering educational material and self-preparation of future specialists in automated engineering;
- to create computer models of the lesson outline, topic, course as a whole; it is the most expedient to place the material;
- to provide basic material with additional information;
- to select and systematize the material taking into account the characteristics of the group and individual students;
- to increase the emotional, aesthetic, scientific persuasiveness of teaching;
- to optimize the process of learning affecting various analyzers;
- focus on the most important problem of the occupation;
- to return to the familiar material at any time; to independently use the educational material by students;
- to systematically accumulate material;
- to visualize educational information using a visual representation on the computer screen of this process including the hidden in the real world;
- to carry out laboratory work in the conditions of imitation in the computer program of a real experience or an experiment;
- to form a culture of learning activities of the student and the teacher.

The possibilities listed above change the structure of the traditional subject, the object pedagogy in which the student is the subject of educational activities, the person striving for self-realization. And the virtualization of some processes with the use of animation serves to form visual-figurative thinking and more effective learning of educational material for future specialists in automated engineering.

The teacher can apply various models of computer use in the classroom to organize his work. They are divided into methodological and organizational. Various forms of information support are used in the practice of teaching chemistry. The simplest and most effective technique is using off-the-shelf software products that have great potential and allow to vary the ways of their application based on the content and organizational features of the educational process[3,4].

The use of graphic means (animation, video, dynamic drawings, sound) will significantly expand the possibilities of learning making the content of educational material more visual, understandable, entertaining.

Computer modeling is indispensable in the study of chemical processes, the direct observation of which is unrealistic or difficult. Modeling chemical phenomena and processes on a computer is necessary to study phenomena and experiments that are almost impossible to show in the laboratory, but they can be shown using a computer.

The use of computer models makes it possible to reveal the essential connections of the object being studied, to reveal its patterns more deeply which ultimately leads to a better absorption of the material. The student can explore the phenomenon by changing the parameters, compare the results obtained, analyze them, draw conclusions. For example, by setting different values of the concentration of reacting substances (in the program that simulates the dependence of the rate of a chemical reaction on various factors), the future specialist in automated engineering can monitor the change in the volume of gas produced, etc.

Computer technologies make it possible to demonstrate reactions with explosive or poisonous substances, rare or expensive reagents, processes that proceed too quickly or slowly, which is impossible under laboratory conditions.

Teaching chemistry is specific compared to teaching other disciplines, as it involves the implementation of practical work. And in this case the computer has become an effective assistant of a teacher.

Of course, conducting experiments in the laboratory has indisputable advantages, but when studying toxic substances such as halogens the virtual world makes it possible to conduct a chemical experiment
without any risk to health. If the office does not have the necessary equipment, using a computer makes it possible to compensate for this shortcoming. IBM has developed a “Personal Scientific Laboratory”, a set of computers and software for them, various sensors and laboratory equipment. It allows for various experiments in the chemical, chemical-physical and chemical-biological areas. The use of a computer is useful because it gives students the skills of research, forms cognitive interest, increases motivation and develops scientific thinking.

Another argument in favor of the use of information technologies is the ability to quickly and efficiently control the knowledge of future specialists in automated engineering. Most of the electronic textbooks contain exercises, simulators, problems with solutions, test items. Separate software products contain an electronic journal that allows recording the level of students’ knowledge on each subject of the course (taking into account not only the mark and the number of decision attempts, but also the elapsed time to complete the tasks). The performance evaluation system makes it possible to determine the student’s rating for each subject, track the progress of the academic progress and adjust the educational process in accordance with the results shown. In addition, the use of supervisory programs contributes to the formation of adequate self-esteem among students. Despite a number of advantages of ready-made software products the information on some of them is very dry. There are errors of fundamental nature. Some tasks are extremely difficult for a student.

Computer presentations are an effective method of presenting and studying any material. Using Microsoft PowerPoint, a standard part of the Microsoft Office suite, can greatly speed up work and improve the teacher efficiency. It can be said that a computer with a PowerPoint installed on it, in combination with a projector and a screen, replaces almost all previously used tools presented.

It is very important that the computer used for presentations (slide system or system of demonstration frames) is installed with the version of Microsoft Power Point, with the help of which the presentation was created.

The use of slide films (Power Point) provides a higher level of the lesson, its information richness, dynamism, visibility. When creating a presentation data are used from electronic textbooks, information on the Internet, the necessary formulas on the slides, schemes of chemical experiments in accordance with the sequence of studying the material in the classroom. In order to timely fill the gaps in knowledge and fix the most important issues of the topic on the last slide the control tasks are put. If students cannot answer any question, then there is an opportunity to return a slide containing information for the correct answer. Thus, the material that caused the difficulties is analyzed. The large set of information objects in the presentation gives the teacher the opportunity to present the object or process under study in the whole diversity of its manifestations and properties. It also allows to more accurately and accurately determine its place and importance in the system of scientific knowledge about the world around us [5, 6].

Slides and presentations can be the most common and can be with the elements of animation. For example, the equation of a chemical reaction can be given at once, but only a fragment of it containing the beginning of the equation can be given. The remaining elements of the equation will appear as the teacher explains the material. Similarly, you can bring a finished drawing on the slide, for example, the Kipp apparatus, and you can show the sequence of its assembly and work in the form of a cartoon. You can insert a link to a video clip into the slide which is launched by the corresponding control key placed by the author on the slide field. You can show a sequence of photos that reflect a real laboratory chemical process or a factory process With PowerPoint.

Power Point can be used for ongoing testing. In this case, a sequence of test tasks, for example, with a closed choice can be presented on the projector screen with a certain time delay. Students need only to fill out a template giving the correct answers to the test tasks. Here you can arrange a self-test of results by submitting a frame containing the correct answers to the test tasks.

4. Conclusion
Summarizing the results of the theoretical and experimental research, the following general conclusions can be drawn.
1. The analysis of the literature shows that the problem of using information technologies in the process of teaching chemistry to future specialists in automated engineering is relevant, requiring its further understanding. Its relevance is due primarily to the need for a scientifically based solution of practical problems of improving the practice of using information technologies in the process of teaching chemistry. The effectiveness of solving this problem depends on the clarification of the principles and types of information technologies, as well as on sufficient pedagogical conditions, along with the necessary ones aimed at solving the research problem we have chosen.

2. The information technology is considered a practical part of the scientific field of informatics, which is a combination of means, methods, methods of automated collection, processing, storage, transmission, use, production of information to obtain obviously expected results.

3. The pedagogical conditions of using information technologies in the process of teaching chemistry of future specialists in automated engineering have been revealed and justified. They are creating positive motivation of subjects of learning to use information technologies, using multi-level tasks for students (individualization of training), developing self-control among future specialists in automated engineering.

4. The study and the results obtained during the experiment confirm the hypothesis put forward and allow concluding that the goal of the study has been achieved.

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