

Using of computer curriculum for teaching chemistry in higher educational establishments

Informatization of education aimed at improving the training process of the professional abilities both teachers and specialists of other sectors of the economy, particularly for the future agrarians. Introduction of the new informative technologies into educational process is based on three elements: the purpose of teaching, learning content and its organization principles.

The purpose of this work is to describe the methods used in chemistry curriculum at the higher educational establishments and to reveal the possibilities of their using at the secondary schools.

The process of the development of skills and abilities for future specialists using the informative technologies in the educational process at the chemistry classes can be effective if it is seen as a whole learning process. We consider that it is necessary to subordinate it to the formation system of practical skills and abilities of computer science competence mastering [Chernov 1987: 116–118]. This process is based on certain teaching methods.

Analyzing the teaching methods we paid attention on the methods by which the process of transferring, reproduction, remembering of the learning information is going on and the transferring them into the practical activity. Their action is conditioned by means of visual perception and information transferring, including the important role of the personal computer presence.

From the visual learning methods we have chosen demonstrating method for our own research. Because it allows to reproduce the action sets, technological schemes, laboratory experiments with the help of computer models.

Choosing the demonstrating method at the using of information technologies we were based on the following factors:

1. The nature of the didactic purpose. Learning takes place at the level of creative applications for example, reproduction.

Features of the discipline:

- All new basic knowledge and a high degree of generalized determination;
- Some new knowledge have medium level of generalization;
- Some new knowledge have a low degree of generalization.

Levels of education:

- full amount of basic knowledge and skills;

- basic knowledge and skills have gaps;
- basic knowledge and skills have significant gaps.

Methodical training of the teachers depends on the ability of the educational process organization at various levels [Arestenko 1993: 191–193].

With computer training there are two approaches to the study of different chemical reactions – video editing and simulation experiments, which is a dynamic process model.

In our studies we have chosen the method of simulation based on such considerations that the students can better:

- to concentrate their attention on features of the studying process;
- to focus on the studying material;
- to choose the desired rate of learning [Hershunskyy 1987].

The essence of the method of simulation in our research consists in the development of software for creating models on electron-mated computers, checking its effectiveness and working positions. Therefore, we have devoted considerable attention in our studies to programming. Simulated modelling in chemistry is essentially mathematical modelling. We took into account that the process of modelling is characterised by several features, among which are the following:

- Performing the role of the peculiar way of teaching.
- Manifestation of the training function in the knowledge model and regularity of the opening formalities, the existence of the object.
- Using as a means of active perception of the learning material.

Due to differences between model and prototype is created the possibility to direct the thinking of students for „disclosure” of the object being studied [Arestenko 2001: 91–94].

We have fulfilled the requirements for a teaching computer program plan.

To create any teaching program mean we need to elaborate the teaching plan. So, first we will focus on basic requirements for the training program plan:

- it is necessary the description of the shot was simple, concise and clear;
- such plan has to include all possible means to effect the reaction machine student; provide maximum comfort while working on the program, including the possibility of training programs as to work forward and back, return to work rules or background information.

A teaching plan is a description of each shot, actions of pupils and computer reactions, reflected in changes in the image on the screen. To facilitate the programist work means to add a verbal description of a graphic image composition shot. These shots have to be numbered.

In every frame it is necessary to forecast „command” line where is information about the regular students’ actions.

At the preparatory stage for writing the script, we respect the educational provisions, which are reflected in works of V. Chernov [1987]:

1. The text was carefully analyzed to be displayed on the screen.

2. Drawings and graphics should be first shown on paper, following the scale.

To display the dynamics of the process we clearly thought about the images of the used symbols (arrows, dots, letters).

The grouping of the text, pictures, and graphs on the display we started after their full preparation work.

When grouping the text we hold of such recommendations and guidelines:

- To save space for the image of the text information we have to choose the fine print;
- Does not cover the entire volume monotonous screen text;
- Text and graphics to place no more than 2/3 of screen space;
- Texts have to be divided into paragraphs logically completed, and compose shots with them;
- Change of the shots should occur quickly [Markhel 1996: 75–82].

When creating a pedagogical plan of the chemical applications we need to use only a chemical language, defined by the Program in Chemistry for a particular school, since students are well acquainted with it exactly.

Examples of pedagogical techniques of script author on the topic: „Spatial Structure and isomerism of alkanes”.

Pedagogical plan of the training program was formed in accordance to the requirements and recommendations outlined above and taking into account with recommendations for the study of spatial structure of the compounds according to Chemistry course.

All training shots of the pedagogical plan of the computer program of this theme are subordinated to a single style and there are not fundamental differences in their organization.

The first two shots are the introductory part of the pedagogical plan. The first shot is a screen illumination, where the studying subject is reported and in the process of its learning we use this task, the theme of the program is Spatial Structure and Isomerism of alkanes. In the second shot the basic rules of the program are given and the possibility of returning to the information is provided in each shot. To do it we have simply to click imitated button „Help”. It should be noted that a pedagogical plan of this computer program forecast such interface of the program in which the possibility of random errors in the implementation of any information is minimized. The requested information is entered with the help of the „buttons” that are simulated on the screen. Clicking on these „buttons” occurs when holding down the „gap”.

Numerical dimensions are entered when you click on the button imitated „more” or „less” and press the first button leads to sequence increase, and second – according to a consistent reduction. In addition, we allow the possibility of recourse to the program at any point in its execution. At the bottom of the screen all of the students’ actions while working with the program are commented.

After it the simulation models of molecules of ethane and pentane are created and at their example we can observe the peculiarities of the spatial structure of saturated hydrocarbons. To create the models the student has to enter the main characteristics of molecules – the quantity of atoms of carbon and hydrogen, length and size of the valence angle.

The peculiarity of such characteristics is checked when you click the button „Check”. If the answer is correct, the transition from one shot to the another shot is carried out, and in the case of errors the student is given one more attempt. Total to enter the answers every student has two attempts. If as a result of these efforts to determine characteristics failed, they are shown on the screen and work with the program continues. Constant using of the most important characteristics of molecules in the process of programming leads to their involuntary remembering.

In the fourth shot students are asked to select one of the three geometric shapes. Selecting a shape is realized by clicking the button with the name of this figure. These „buttons” are located directly under the image of each geometric shape. The result of this choice will be a notice of its soundness or irregularity and the transition to the next shot.

Fifth shot illustrates the tetrahedral constitution of methane molecule. Tetrahedron and molecule methane model move to meet one another and as a result of it the molecule model is placed in the centre of tetrahedron.

In the following shots we can observe various spatial shapes of ethane molecules and presented graphical information is commented by the text.

Also there is presented demonstration of the rotation of CH₃ group around the chemical net of C-C in pentane molecule and as a result of the rotation the different spatial shapes are formed. Answers to these questions are performed by the clicking on one of the provided buttons „Yes” or „No”.

Literature

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Abstract

Such approach to the using of these training programs can be proposed for the studying other general subjects. This will facilitate the development of interest to study chemistry as well other general subjects, and motivate the choice of occupations based on knowledge of chemistry.

Key words: computer teaching program, information technology, college.

Wykorzystanie programu komputerowego w nauczaniu chemii na poziomie szkoły wyższej**Streszczenie**

Zaproponowany sposób wykorzystania technologii informacyjnych w nauczaniu chemii może być także z powodzeniem zastosowany w odniesieniu do innych przedmiotów. Oprogramowanie dydaktyczne ułatwia rozwój zainteresowań uczących się chemią oraz innymi przedmiotami ogólnokształcącymi, może być także czynnikiem motywującym w wyborze zawodu.

Słowa kluczowe: komputerowy program dydaktyczny, technologia informacyjna, szkoła wyższa.