TEACHING METHODS SPECIFICS FROM THE PERSPECTIVE OF VISUAL MODELLING APPLICATION

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Nowadays teachers and psychologists talk about special cognitive style of modern students, highlighting their inability to absorb a large amount of information, to deepen into the essence of the studied concepts, to apply them to solve the subject problems. In science teaching, this results in the occurrence of difficulties related to misunderstanding of the learning material. Such difficulties arise in chemistry because of a high-level abstraction of the studied processes and phenomena itself, because one cannot touch an atom, a molecule, see the breakage or formation of a chemical bond. Therefore, the most common cause of misunderstanding of chemistry is the lack of spatial and visual representation of chemical information.

The aim of the article is to provide a theoretical justification for the use of visual modelling in the educational process.

Material and methods. The material of the research was normative-legal and programmatic-methodological documentation on the problem of the research works of scientists (educational standards of the Republic of Belarus, curricula, etc.) on visual modeling application in the educational process, the authors' experience of working with students.

Findings and their discussion. General logical (comparison, analysis, generalization, systematization), general pedagogical (lecture, conversation, independent work) and specific teaching methods have been used in the course of general chemistry. From specific methods for this subject the most relevant ones are observation of chemical objects and their images; chemical experiment; solution of calculation tasks; modeling of chemical objects; description of chemical objects, explanation of chemical phenomena. All these methods are applied in combination in practice; they integrate mutually and complement each other. Visual modelling offers unlimited opportunities for such integration, allowing models to be incorporated into almost all teaching methods. Let us consider the classification and types of educational models used in general pedagogical methods of teaching chemistry in more detail.

The presentation of lecture material in general chemistry implies the constant use *of symbolic models* (chemical symbols), *Tabular-symbolic models underlie* methods of comparison, analysis, systematization, classification. These models allow structuring chemical information, finding relationships between individual objects, predicting chemical properties of substances under study. For systematization of theoretical knowledge, it is convenient to use tabular models "Fundamental concepts and laws in the structure of the content of general chemistry"; "Classification of inorganic substances"; "Qualitative reactions to cations and anions". Drawing up of supporting notes on "Thermodynamics of chemical reactions", "Chemical equilibrium", and "Chemical kinetics" contributes to a better assimilation of the material and its organization into a certain system. *Illustrative-graphic* and *illustrative-dynamic* models are indispensable for studying the structure of the atom and the periodic system of chemical elements, as this material is characterized by a high degree of abstraction [1].

The multifaceted possibilities of visual modelling are used in preparation for general chemistry labs at all stages of the lab (testing theoretical knowledge and practical skills; solving calculation problems; conducting a chemical experiment). In addition to the above-mentioned models, comics, computer animations and virtual laboratories can be used here.

Let us look at concrete examples of the use of visual modelling in the teaching of general chemistry.

Often, for the sake of clarity, chemical compounds are represented graphically by showing the sequence in which the atoms are connected to each other in a given substance molecule. The symbol of each element is represented by a number of dashes equal to the valence of the element in that compound.

It should be kept in mind that the graphical representation of formulas does not always reflect the actual arrangement and bonding of atoms in a substance molecule. Therefore, a graphic representation should not be equated with *a structural formula*. Structural formulas, while depicting the order of connection of atoms in a molecule, do not, however, reflect their actual spatial arrangement.

With the help of *spatial models*, it is possible to visualize the connections between atoms and their mutual arrangement. A correct representation of the filling of the intramolecular space can be obtained by using spherical rod and hemispherical (Stewart-Brigleb model) models of molecules.

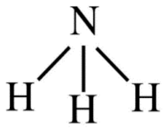
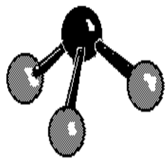
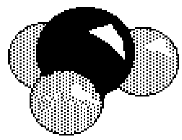
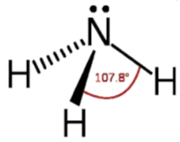
Ball-and-stick models of molecules make the relative position of atoms in space visible, but do not correspond to the actual ratio of atomic radii and chemical bond lengths. They are assembled from balls symbolizing individual atoms. The balls-atoms are placed at some distance from each other and are fastened together by a rod base.

In *Stuart-Brigleb hemispherical models*, atoms are represented as truncated spheres with their sizes taken into account. These models are often called scale models and are widely used to establish the possible degree of convergence of groups in a molecule.

However, it is often necessary to represent the spatial structure of a molecule on the plane. It is clear that it is inconvenient to use drawings of models, and not everyone can do it. In such cases, various projection formulas are resorted to prospective formulas. In the perspective formula, solid lines represent connections in the plane of paper, a solid wedge represents connections that emerge from the plane of paper, and dashed lines represent connections behind the paper.

Structural formulas, spherical, hemispherical, projection models help us to visualise the atoms connecting to each other in molecules. Table 1 shows several ways of representing an ammonia molecule.

Table 1 – The way in which molecules are depicted

Molecular	Structural	Ball and socket	Hemispherical	Prospective (wedge-shaped)
NH_3				

Thus, our analysis has confirmed the need to use visual modelling in teaching general chemistry. From our point of view, the selection of content and methods of teaching general chemistry should be based on the following requirements:

– the selection of the types of training models should be based on the objectives of the lesson, the programme and the training material.

– the structure of a general chemistry course from the perspective of visual modelling should be multi-level;

– a combination of traditional teaching methods and visual modelling should be predominantly used in the presentation of the selected content;

– the use of models should take into account existing achievements in this respect and the current level of information and communication technology development.

Conclusion. Thus, the specifics of the use of visual modeling is that it should be optimally combined with other methods of teaching to ensure the integrity of ideas about the studied chemical objects and phenomena, contributing to a better understanding and assimilation of the material on general chemistry.

1. Otvalko, E.A. Visual modeling as a means of teaching chemistry / E.A. Otvalko, E.Ya. Arshansky // Chemistry at school. – 2021. – № 3. – P. 11–20. – URL: https://rep.vsu.by/handle/-123456789/26526 (date of access: 22.10.2022).

PHUBBING AS A MODERN PROBLEM

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The XXI century is characterized by the dynamic informatization of society, the penetration of modern technologies into all spheres of life. Currently, an integral part of a person is a smartphone with access to the Internet. The invention of this gadget has a number of advantages, but we do not always deal with a positive effect.

Since the creation of the mobile device, new functions are constantly being introduced into it. However, the improvement of this invention's capabilities leads to the loss of certain skills, abilities and aspirations of a person. The process of socialization is especially strongly influenced by the smartphone and the World Wide Web. With