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# ХИМИЯНЫ ОҚЫТУ ӘДІСТЕМЕСІ МЕТОДИКА ОБУЧЕНИЯ ХИМИИ METHODS OF TEACHING CHEMISTRY

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## **Implementation of new forms of works for formation of skills of information critical analysis**

Technology of critical thinking development aimed at gaining new knowledge, including on the basis of knowledge which is already available through its critical analysis. The main condition for the development of critical thinking is not a presentation of a specific and limited amount of information, but motivation of interest in the Chemistry study, the critical assessment of the proposed theoretical and empirical material by students and then synthesizing them in their activities. To develop skills of critical analysis the new forms of independent work have been introduced. With the aid of reflexive questions the students' attitude have been ascertained. There are many techniques and strategies to generate critical thinking. In this paper we have highlighted some of the most popular and productive methods, besides it was necessary to take into account the possibility of its use in Chemistry lessons. Each method allows diversifying the learning process, which often consists of one activity: written or oral.

*Keywords:* critical thinking, modernization, analysis, reflection, Venn diagram, techniques, strategies, presentation.

Creation of conditions and the use of various learning tools that can generate students' critical thinking is one of the main tasks of the successful implementation of the modernization of education, so now many educators and psychologists conducted theoretical and empirical search for the creation of these conditions.

Students themselves should set goals and choose ways to achieve them, to use the knowledge acquired at school in real life, beyond the educational process.

Critical thinking development technology aimed at obtaining new knowledge, also on the basis of knowledge already available through its critical analysis. In more detail about technology of development of critical thinking, about the methods and strategies proposed by it, it is described in this source [1; 89]. For example, an effective study of the theme pH of the solutions is possible only with thorough knowledge of such concepts as hydrolysis, dissociation, strong, weak acids and bases. I.e. studied information should have a causal relationships and a logical sequence. It is also important that students do not perceive the information received from the teachers as undeniable truth without the possibility of its sequential analysis. For example, when studying the theme «The structure of electron shells» distribution of electrons along energy levels (electron arrangement in cells) is perceived as a given, or that in a molecule consisting of two different kinds of atoms, such as CO<sub>2</sub>, is polar covalent bond, although this oxide is not pole.

With the development of information technology, the Internet, everyone can access the specialized knowledge at any point and almost instantly. Simultaneously with the appearance of unlimited access absolutely to all information, is increasing the risk of links, the study of unreliable sources with not quite trustworthy information.

Considering all the above arguments, first-year students need to develop the ability to critical analysis of information. For this you can use new forms of independent work, contributing to the development of critical thinking.

We carried out a pedagogical experiment on the subject «Chemistry of elements» classes, in which took part first-year students. Earlier we have written an article about implementation of techniques and strategies proposed by technology of development of critical thinking and the impact of these forms of work on the learning activities of schoolchildren [2]. Only the first year students were selected to participate in the experiment, as schools still maintained the linear system of training represented by a class-and-lesson form of organization of educational process, where students study subjects strictly sequentially in a specific amount for a certain period in the classroom. Universities Students use a credit system, which is aimed at increasing the level of self-education, and to individualization student learning pace. Therefore, first-year students are less prepared for the individual form of organization of learning, where they have to develop knowledge on their own. It is also one of the reasons why the first year students took part in the experiment is that at school students use one or two books, when they come to University, they do not have a unified textbook for learning. This is also one of the difficulties in finding and studying the information.

The aim of the pedagogical experiment was to teach the students a critical analysis of incoming information. The experiment was conducted in a period of 4 months, 24 people were involved. According to the program of the discipline at every lesson describes a specific group of elements, such as group 15, group 16 and their separate agents, the compounds which they form and characteristic properties of these compounds. To maximize the assimilation of information flow through its critical analysis, we decided to use the group training that has allowed us to analyze simultaneously emotional and functional comfort of students when training in groups.

Before reading every lecture on the topic of discipline students write their own abstracts. To evaluate the effectiveness of composed abstracts the students were asked to answer a number of questions on the topic, using only their abstracts. At the end of the lesson the students were asked the following questions:

1. Do you consider your abstracts effective?
2. The abstracts helped you when answering the questions?
3. Do you consider you need to learn how to compose more effective abstracts?

The survey revealed that the majority of students believe that their abstracts were imperfect. For most students abstracts are mechanical rewriting of the text from the textbook, without analyzing the information, which entails a lack of systemacy of knowledge. For example, students describe the sectors that use nitrogen, but they cannot explain why it is used, due to what property it is widely used in a particular sector.

Before the start of the experiment we have chosen the form of independent work that promote the development of critical thinking skills, that as a result would have led to mastering the skills of presenting the results of their analysis in a variety of forms: a collective presentation, a Venn diagram and schemes.

Presentation (duration 15–20 minutes) is prepared by students who were previously divided into groups. For example, in the lesson on the topic «15 group», where the main members are nitrogen and phosphorus, as the basis for the dividing of students into groups, we used the degree of oxidation of specific for the given elements. If a student receives a card with a «+5», then he falls into the group, which had to characterize all nitrogen compounds, where it has an oxidation state +5. The main requirements for the presentation were: own critical analysis of information, close contact with the audience, persuasiveness and creative presentation of information using the examples. Perhaps, work on a collective presentation helps to gain the greatest number of skills and competencies, as besides analytical skills also develops an ability to assign responsibilities, skills of oral effective presentation.

After the completion of work the students have been proposed a number of issues for introspection, where the students had to answer yes or no:

1. I analyze in detail the content of the training material and carry out its selection.
2. I propose to the group the ideas to maximize the presentation effectiveness of the material.
3. Build the logic and sequence of presentation of educational material in preparation for presentation.
4. Plan my speech according to the requirements of the presentation.

After processing the survey results, the following data were obtained: 62 % of students rate their educational activity as high, 38 % — as low.

For clarity the results of the responses to questions for introspection are presented in Figure 1.

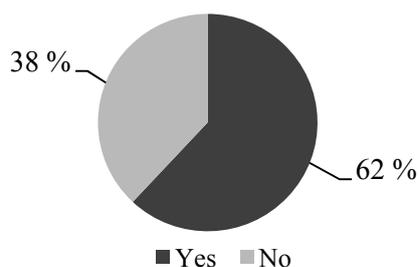


Figure 1. Student's introspection

Also one of the new forms of work has been the development of schemes. The scheme is used for the visual structuring of a theme, allocation of the main structural elements and establishing links between them. These schemes help the students to see not only the features of the objects, but also allow you to memorize the information faster. The scheme allows preparing homework more qualitatively, since it is already a finished reminder that was made on the lesson. It is necessary to ask questions to those who made the scheme. These questions should be free-response questions. This work has allowed to develop in students besides the ability to work to the text, the following skills: highlight keywords, organize the necessary information, analyze, compare and summarize information, development of monologic speech, as well as the students have a need to look for additional information, as it happens that not all the issues are covered in class. These questions remain as homework, which takes the form of fascinating work with information.

Another form, used by us for individual work of students is Venn diagram. The first technique was described by English scientist John Venn in his book «Symbolic Logic». This is a graphical way that is used when you need to compare two or more concepts, methods, objects. «Venn diagram» help to identify common in two or more events, highlight the differences and summarize knowledge on the stated topic [3; 175]. A lesson identifies two or more concepts, terms, events that you need to compare. For example, it is possible to compare the structure and properties that are inherent in nitrogen and phosphorus (Fig. 2). Students draw diagrams, fill the graphs. At the stage of comprehension takes place a discussion of diagrams in groups.

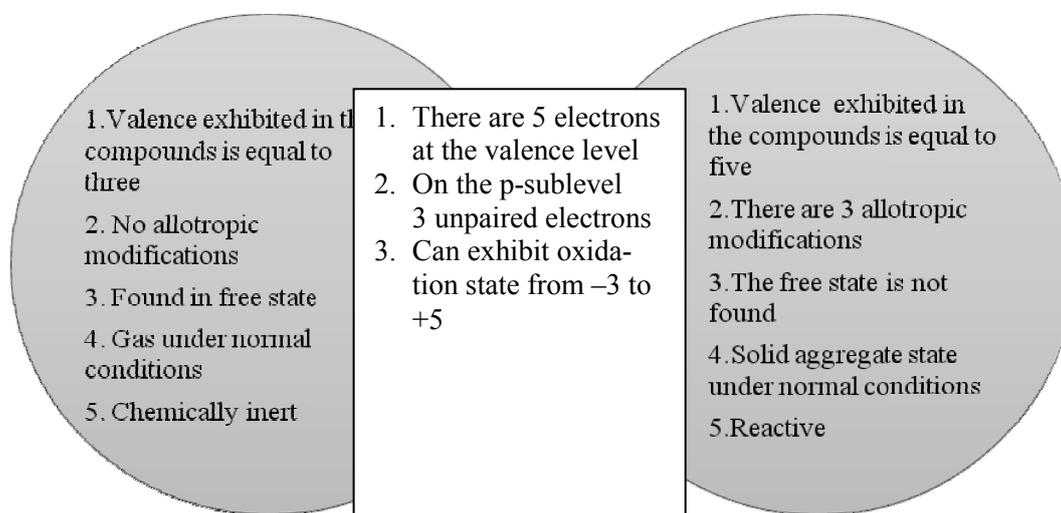


Figure 2. Venn diagram for nitrogen and phosphorus

At the last lesson we carried out self-reflection in order to identify the perception of students of new forms of work. For this the students were given questionnaires with the following questions:

1. Did you like the new ways of working with information?
2. Did you easily manage with providing information in the form of schemes, diagrams and presentations?
3. What do you think, whether this ways of work help to improve the quality of knowledge in the discipline?
4. Would you like to continue to use these ways of work on the lessons?

After processing the survey results, the following data were obtained (see Table).

The results of survey

Answers	Number of students	%
Yes	14	59
No	8	33
Difficult to answer	2	8

The results of this survey are shown in a Figure 3.

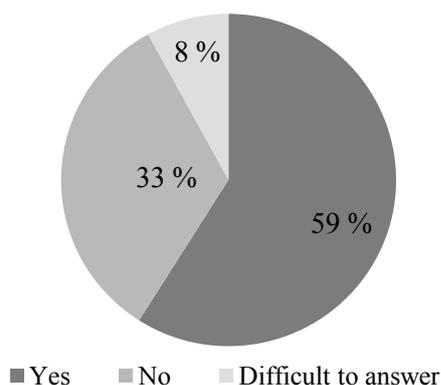


Figure 3. The results of survey

As the results of the survey, most students liked the new ways of work, and they would like to use them in future.

Despite the variety of approaches to the study of the problem and opinions of different scientists, there is a common opinion that critical thinking which is developed enough is an integral part of an effective teaching, good training material possession and use of the information obtained in ordinary life.

There are many techniques and strategies to generate critical thinking. In this paper we have highlighted some of the most popular and productive methods, besides it was necessary to take into account the possibility of its use in Chemistry lessons. Each method allows diversifying the learning process, which often consists of one activity: written or oral.

When using this program, the teacher is not just a source of new information, but also helps in a quality assimilation of information.

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### Ақпаратты сын тұрғыдан талдау дағдыларын қалыптастыру үшін жұмыстың жаңа түрлерін енгізу

Сын тұрғыдан ойлауды дамыту технологиясы жаңа білім алуға, оның ішінде оны сын тұрғыдан талдау көмегімен алынған білім негізіне бағытталған. Ақпаратты шектелген көлемде және толықтай баяндамау, ал олардың химияны зерттеуге деген ынтасының оянуына итермелеу, берілген теориялық және эмпирикалық мәліметтерді оқушылардың сын тұрғысынан бағалауы және бұдан әрі оларды өз мүддесіне қолдануға жинақтау алуы сын тұрғысынан ойлаудың негізгі шарты болып табылады. Сын

тұрғыдан талдау дағдыларын қалыптастыру үшін өзіндік жұмыстың жаңа түрі енгізілді. Рефлексивті сұрақтардың көмегімен студенттердің жұмыстың жаңа түріне деген көзқарастары анықталды. Сын тұрғысынан ойлауды қалыптастыруға мүмкіндік беретін амалдар мен жұмыс түрлері жеткілікті. Тәжірибеде таныс, түсінікті, әрі өнімді бірнеше жұмыс түрлері қолданылды, мұнымен қоса олардың химия сабақтарында қолданылу мүмкіндіктерін ескеру қажет болды. Бұл амал-тәсілдердің әрқайсысы оқыту үрдісін түрлендіруге мүмкіндік беретін бір жұмыс түрінен құралған (жазбаша немесе ауызша).

*Кілт сөздер:* сын тұрғыдан ойлау, жаңарту, талдау, рефлексия, Венн диаграммасы, тәсілдер, стратегия, тұсаукесер.

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### **Внедрение новых форм работы для формирования навыков критического анализа информации**

Технология развития критического мышления направлена на получение нового знания, в том числе и на основе уже имеющегося знания при помощи его критического анализа. Главным условием развития критического мышления является не изложение конкретного и ограниченного объема информации, а провоцирование побуждения интереса к изучению химии, критического оценивания учениками предложенного теоретического и эмпирического материала и далее синтезирование их в своей деятельности. Для формирования навыков критического анализа были внедрены новые формы самостоятельной работы. С помощью рефлексивных вопросов установлено отношение студентов к новым формам работы. Существует огромное количество приемов и форм работы, позволяющих сформировать критическое мышление. В данном эксперименте были применены несколько наиболее популярных и продуктивных форм работы, к тому же необходимо было учитывать возможность их применения на занятиях по химии. Каждый из приемов позволял разнообразить учебный процесс, который зачастую состоит из одного вида деятельности: письменного или устного.

*Ключевые слова:* критическое мышление, модернизация, анализ, рефлексия, диаграмма Венна, приемы, стратегии, презентация.

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