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Implementing Interactive Teaching Methods for 9th Grade Organic Chemistry Classes

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Abstract: *One of the main challenges facing the current educational system is creating conditions suitable for academic skill development that allow students to navigate and adapt to today's modern society, such as locating relevant information quickly as well as effectively utilizing innovations. We can achieve this objective by using interactive teaching methods. These methods take into account the contemporary issues and changing priorities - from the general content building for the courses to independent, student-centered cognitive activities.*

The purpose of this paper is to present tested and proven interactive methods for Grade 9 Organic Chemistry classes. These methods significantly improve the quality of teaching and the students' interest in the subject.

Keywords: *teacher training, organic chemistry, interactive methods*

Introduction

The use of interactive teaching methods in schools is extremely popular nowadays because students are equipped with the necessary life skills for modern day society, which are: generating ideas, formulating and verifying hypotheses, discussions, and decision making. Whether directly or indirectly, these methods are reflected in the work and recommendations of various European institutions, national strategies and programs, including: the Council of the Ministries of Education, Youth and Culture of the European Union, the European Institute of Innovation and Technology, the European research strategy, as well as innovation in information and communication technologies operating by 2020 and others. [1]

Interactive methods are appropriate to pursue a quality learning process and are fully consistent with both the need to have creative individuals and the quest for socialization, in particular, for the communication of each student. These methods are one of the possible ways to carry out more effective learning activities, motivating, focused, and well organized because the lack of participation in the classrooms is eliminated and students' work is enhanced. [3]

Results and discussion

In a quest for the most favorable ways to improve the preparation and activity of students in the process of teaching chemistry and environmental protection, we focused on the opportunities offered using interactive methods. This work presents part of the results achieved from teaching organic chemistry to students in the 10th grade at the "Dr. Petar Beron" School of Mathematics in Varna as a pedagogical experiment.

A survey, held in previous years, shows that students are interested in learning in an interactive environment. That defined the goal of the pedagogical experiment, namely: to develop and implement training system in organic chemistry lessons using interactive teaching methods.

The first stage of the project consisted of an analysis of educational content. We researched appropriate topics to meet the objective. [2] The results are presented in Table 1.

Table 1. Applications of interactive methods for educational content.

	Topic	Used interactive methods
1.	Hydrocarbons (summary)	<ul style="list-style-type: none"> ➤ brainstorming ➤ game ➤ discussion
2.	Natural sources of hydrocarbons	<ul style="list-style-type: none"> ➤ debate ➤ case study ➤ discussion ➤ role-playing game ➤ developing the project
3.	Physiological effect of ethyl alcohol	<ul style="list-style-type: none"> ➤ developing the project ➤ case study ➤ discussion
4.	Carbonyl derivatives of hydrocarbons	<ul style="list-style-type: none"> ➤ method of associations ➤ discussion ➤ content analysis ➤ teamwork ➤ developing an intellectual card
5.	Carboxylic acids	<ul style="list-style-type: none"> ➤ teamwork ➤ brainstorming ➤ content analysis ➤ discussion
6.	Narcotic substances	<ul style="list-style-type: none"> ➤ case study ➤ brainstorming ➤ developing the project

In the second stage of the experimental lesson, fragments and private lessons were developed with embedded interactive methods of training. In the next stage, these methods were approved in the learning process.

We have presented some of the developed methodological options, which illustrate the ability to use interactive methods in the learning process in a specific order, based on the curriculum map.

In the summary entitled "Hydrocarbons," we play a game called "The World of Organic Chemistry." The game takes place in four rounds where the competitors solve different types of problems. The class is divided into two teams - Team "Markovnikov" and team "Kucherov". The team who has the highest amount of points wins.

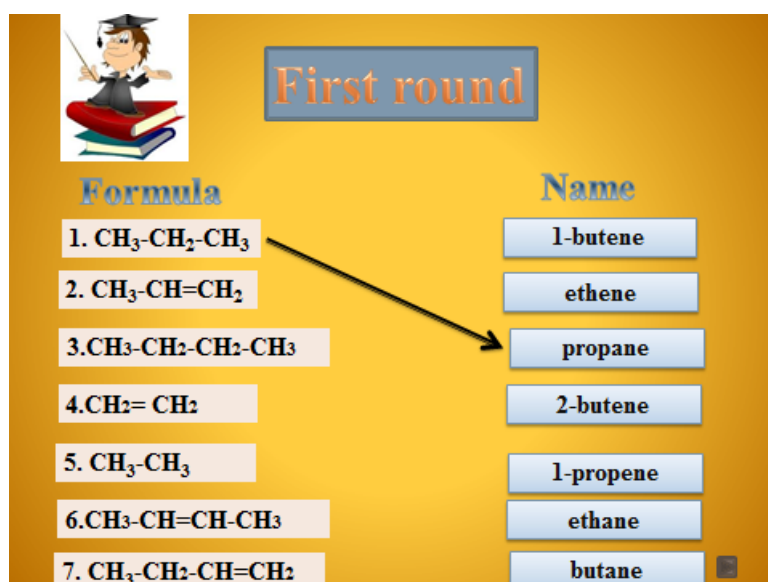


Fig. 1.

The topic named "Physiological action of the ethyl alcohol" is organized and conducted using group and project work. This method encourages active participation of students in the creation of a product. The lesson is not provided by the teacher, however, the students work independently to locate information by selecting and structuring it, and finally, presenting that information.

Project activity is organized in the following sequence:

Stage One: Students are informed about the topics of the project, they form groups to work on the tasks (In this lesson the groups are 5). The students discuss the final product, which leads to the finalization of the project and the elements it should contain. Accurate and clear guidance is given on the criteria, which will be used to evaluate the group work.

Second stage: Students distribute the tasks within the groups. An important element of the group work is the participation of everyone in the team. At this stage, the sources of information are studied, various options of presenting the results of the work are discussed, and the final product is developed. It is presented to the teacher during the planned consultation. Errors, necessary additions and corrections are being discussed during that time.

Third stage: The final version of the product is developed.

Fourth stage: The finished product of each group is presented to the class. The presentation takes place during class within the given time limit.

Fifth stage: Evaluation of the product. It is performed by a panel of students who are familiar with the topic and know the criteria to evaluate the finished products. Students are required to justify their decision to the class.

Topics for the groups:

First group: The physiological effect of alcohol. (The path of alcohol in the human body)

Second group: Alcohol - the legal drug.

Third group: Poisoning by methyl and ethyl alcohol. First aid help.

Fourth group: Alcoholism and crime.

Fifth group: Alcohol in folk art.

Each group receives a card from the teacher which indicates the topic, the questions that must be answered, and the tasks that must be fulfilled.

As an example, we will present the guidelines for the first group.

1. Check the transformations of ethanol in the human body.
2. Imagine in your own way the path of alcohol in the body.
3. Clarify the influence of alcohol when taking medicines and drugs.
4. Why do we feel the need to drink water after consuming alcohol? Explain using the properties of ethanol.

5. In developing the final product remember to cite the sources of information that you used.

Criteria for the evaluation of the product:

1. Relevance between the content and the theme.
2. Quality of the finished product:
 - ☐ properly selected text information
 - ☐ pictures and graphic material content associated with the given theme
 - ☐ successful use of animation effects
 - ☐ originality and creativity
 - ☐ correct citations using credible sources, such as the Internet
3. Presentation of the product:
 - ☐ reasonableness and accuracy of the exhibition
 - ☐ met objectives
 - ☐ how well the content is learned, mastered; the display of the presentation and whether the questions from the audience are properly answered
 - ☐ use of correct chemical and literary language

In addition to the presentations and brochures, the students perform a chemical demonstration - the effects of the ethyl alcohol on the liver and a demonstration of first aid help when one is suffering from alcohol poisoning, presented by the nurse at the school.

The topic "Natural sources of hydrocarbons" aims to enrich the ecological culture of students. The lesson is presented in the form of a role-play game - a press conference with a topic concerning an ecological catastrophe near Burgas.

In order to perform this, a scenario is prepared and students receive roles of journalists, experts and representatives of the Regional Inspectorate of Environment and Water.

The problem that caused the press conference is reported by the representative of the Regional Inspectorate of Environment and Water: Dear colleagues and journalists, during the day, rescue teams struggled with over 30 tons of gasoline, which expired yesterday near the town of Burgas. The fuel is poured in an accident on an oil pipeline of "Lukoil" and that is a threat to the protected area of Vaya. Due to heavy rain the work of the teams is difficult. My colleagues from the Institute of Chemical Engineering will respond to the journalists' questions, regarding the problems that the pollution may cause.

Later, the journalists and experts join the press conference, ask appropriate questions and provide relevant answers.

So, the conducted interactive lesson assists students in an unconventional way, helps them acquire knowledge about the use of oil and gas, the need for rational use of natural resources and environmental problems, which can cause an incorrect exploitation of the facilities in the oil industry.

In the summary entitled "Carbonyl compounds," we used teamwork in the building of an intellectual card.

Having examined the methods of production, composition, structure and physical properties of carbonyl compounds, students are divided into 2 groups. Each group receives a leaflet with instructions about creating an intellectual card. The objective of the first group is to build an intellectual map of the concepts, related to the chemical properties of the carbonyl compounds. The second group must aim to build an intellectual map of the concepts, related to the physiological effect of aldehydes and ketones.

With the construction of the intellectual map, its protection is also developed. Each group presents its intellectual card and the result is evaluated by the entire class. At this point, the group work is being combined with teamwork.

The theme "Drugs" is part of the curriculum of learning chemistry and environmental studies in the 9th grade. It has always sparked interest among students, as it is considered one of the most important social problems of modern day society. Upon the learning of this topic, various interactive methods are used, as well as different forms and techniques, such as: project-based learning, case studies, role play, group work and more. The purpose is to encourage students to exchange information and opinions, share personal experiences and discuss the actions that must be taken in a particular situation.

To conduct the lesson in the form of project-based learning, students are divided into 4 groups, which should prepare them for the task by gathering information and answering the following questions:

1. What is a drug?
2. What is the difference between hard and soft drugs?
3. What is an addiction?
4. Who uses drugs and why?

The first three groups were given the task to study the information for one of the following drugs - amphetamines, morphine, heroin and to present in a way chosen by them the research results in the following order: What is heroin / morphine / amphetamine? How do you take this drug? What are the effects of its use? Is it addictive? What are the risks? How do you recognize problematic use? How to help the addict?

The fourth group was given the task to prepare a presentation (poster) on the topic: "Drugs - risks addiction and prevention. I chose to say NO, how about you? "

Upon completion of the group work, the main factors that lead to the use of drugs and the signs of drug dependence are displayed on the intellectual card in the right order.

The next task which is provided to the groups is an analysis of the "Tree of problems."

Students are divided into two groups and each of them gets a flip chart with a painted tree with big roots and branches with leaves and fruits. The trunk of the tree contains the following scenarios:

- Simona, 18 years, three months pregnant, lives with HIV for four months, uses drugs.
- Alexander -19 years old, injects himself with drugs, lives on the street.

Each group reflects on the possible causes of the problem and writes them on the tree's roots, then the members analyze the consequences and write them on the branches and fruits. The group discusses the links between the individual factors, while indicating them with arrows. Students offer possible strategies and steps to solve (decrease) the problems.

The last task involves solving cases related to the topic - "Drugs." For the purpose of this activity, the class is divided into two groups and each group must decide on a case.

Case 1:

Several times your best friend Yavor borrowed money from you, but delayed its return using different explanations. You understand that he had started taking hard drugs. You have grown up together, you know his family and you know him as an extremely intelligent and knowledgeable person. Will you try to help him? How?

Case 2:

While returning from lectures, Simona finds her brother Nikolai in their home unconscious. She realizes that his condition is caused by overdosing or the consumption of a poor quality drug / mixture poisoning /. What should Simona do?

After 10 minutes of discussion the chosen spokesperson of the group presents the solutions and answers questions.

Conclusions

In order to determine the attitude of students towards the use of interactive methods during the learning process, a survey was conducted at the end of the school year. The results showed that students enjoy working in an interactive environment (69%) and this positively affects their attitude towards the subject.

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