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THE EFFECTIVENESS OF USING THE CASE-STUDY METHOD IN TEACHING ORGANIC CHEMISTRY

Imangazinova Zh.

Zhetysu University named after I. Zhansugurov, Taldykorgan, Kazakhstan
e-mail: Gema.232@mail.ru

The article discusses the effectiveness of the use of modern active case-study teaching technology in teaching organic chemistry in higher educational institutions, the role of students in the formation of skills of analysis, accumulation, assessment, deep assimilation of theoretical knowledge.

To reveal the content of the topic, the results of an experimental and experimental study conducted from 2021 to 2022 in the educational program 6B01506-Chemistry with the aim of identifying effective methods for the formation of special subject and Universal interdisciplinary competencies of students based on the practical application of communicative, exploratory, creative, theoretical knowledge in the study of basic and profile disciplines.

In the article, the formation of creative views of students when using Case-study Technology in laboratory classes in organic chemistry is heard, methods of free expression of thoughts in the group, effective use of knowledge acquired in the lecture in laboratory classes are differentiated.

Keywords: *case-study, situation, analytical skills, communication skills, self-differentiation, SMART goal.*

Introduction

The case method, or the method of teaching using real situations, appeared at the beginning of the XX century at the Harvard University Business School in the USA. The term "case study method" was first used in the works of the American scientist Copeland. In 1921, Copeland published a collection of real teaching situations and demonstrated how to use the case study method.

In the 80s and 90s of the 20th century, the case method was widely used all over the world, including the USSR, especially in economic subjects. From this period G.A.Bryansky, Yu.Ekaterinoslavsky, O.V.Kozlova, Yu.D.Krasovsky, V.Ya.Platov, D.A.Pospelov, O.A.Ovsyannikov and other scientists made a great contribution to the implementation of the case study method. The case study method allows you to illustrate academic theories in terms of real-life situations. This allows students to study the subject, gain in-depth knowledge, process and analyze information, distinguish and distinguish different situations.

The following main stages of creation of cases: definition of goals, assignment of criteria for different situations, identification of necessary sources of information, preparation of initial case materials, expertise, preparation of methodological materials on its application. The technology of working with cases in the educational process consists of the following stages:

1) individual work of researchers of case materials (identification of the problem, formulation of the main alternatives, presentation of the proposed action or solution);

2) work with small groups related to the introduction of the main problem and its solution.

3) presentations of small groups in the general discussion (within the study group) and results of practice.

The case-study method develops the following skills:

1. Analytical skills. They include the following: the ability to separate data from information, the ability to distinguish between important and irrelevant information, analysis, visualization and access to them, the ability to find and restore missing information, etc. Ability to think clearly and logically. This is especially important if the information is of low quality.

2. Practical skills. The low level of complexity of the problem compared to the actual cases presented in the case allows systematization of practical skills used in economic theories, methods and principles.

3. Creative skills. The problem is not solved with a single Case according to the rules. Here, the creative skills of alternative solution generation, which cannot be solved in a logical way, are very important.

4. Communicative skills. Among them, the following can be noted: the skill of conducting a discussion, conveying the vision of the surrounding people. The use of visual material and other media items - joining groups, defending one's point of view, conveying the point of view of opponents, preparing a brief version of the report.

5. Social skills. During the discussion, specific social skills are formed in Case: self-assessment of people, ability to listen, support the discussion or prove the opposite point of view, i.e., self-control, etc.

6. Self-differentiation. Disagreement during discussion helps to better understand and analyze the opinion of others and one's own. The arising moral and ethical problems require the formation of social skills to solve them.

Materials and methods

During the period of 2021-2023, in the course of teaching organic chemistry, we conducted studies in the direction of determining effective methods of in-depth learning of complex theoretical concepts based on the use of case study technology.

As a primary source of information, the analysis of the scientific works of methodical scientists who studied the previously published technologies of teaching chemistry, and the analyzes of the data obtained during the laboratory-experimental classes were used.

During the preparation of the article, methods of laboratory analysis, research, collection, evaluation were used.

The use of the case method is not limited only to teaching, this method is also actively used as a research method. In addition, it is one of the real ways to increase the professional competence of the teacher by combining the content of learning, knowledge and research in education. The effectiveness of this method is that it can be easily combined with other learning methods.

Main part

Creating a categorical apparatus of the method helps to gradually increase the efficiency of its use, and also opens up new opportunities for the method of technologization in the educational process. The main concepts used in the case method are "situation" and "analysis", as well as the concept of "situation analysis" arising from them.

Lesson organization stages:

The stage of commitment to joint action:

The main task of this stage: creation of evidence for joint action, identification of the initiatives of the participants in the discussion.

At this stage, the following work options are possible:

- The text of the case study can be distributed to students before the start of the lesson for independent study and preparation of answers to questions.

- At the beginning of the lesson, the students' knowledge of the case study materials and their interest in the discussion are determined.

- The main problem underlying the case study is identified, and it is coordinated with the relevant part of the course.

Stage of organization of joint action:

The main task of this stage is: - organization of activities to solve the problem. Activities can be combined in small groups and individual. The listeners are temporarily divided into small groups to prepare a collective answer to a question in a certain amount of time given by the teacher. In each small group (independently of other groups) there is a comparison of answers, their processing, production of an individual view, which is formalized for presentation. In each group, a "spokesperson" is chosen or

appointed to deliver the solution. If the case is well-constructed, then the decisions of the groups should not be inconsistent. Speakers present the solutions of groups and answer questions. The teacher organizes and guides the general discussion.

The stage of analysis and reflection of joint action:

The main task of this stage is: - determination of educational and educational results with the results of case work. In addition, at this stage, the effectiveness of the organization of the lesson is analyzed, the key issues of the organization of joint activities are determined, and tasks for further work are set. The actions of the teacher can be as follows: the teacher ends the discussion by analyzing the process of discussing the case study and the work of all groups, gives a brief explanation of the real development of the story, draws a conclusion.

Case structure:

Despite the variety of cases, they all have a typical structure.

According to the rules, the case consists of the following parts:

- Circumstances - a random situation, a key issue, a story from real life.
- Context of the situation - chronological, historical, place context, features of actions or participants in the situation.
- Commenting on the situation proposed by the author.
- Questions and tasks for working with the case.
- Attachments.

Case assembly stage:

- Determining the position of the case in the system of educational goals.
- Search for an institutional system directly related to the case topic.
- Create or select a situation model.
- Create a description.
- Collect additional information.
- Preparing the final text.
- Presentation of the case, organization of discussion.
- Organization of case work:

There are many options, and this is an opportunity for the creativity of the teacher. We offer a maximally generalized lesson model that can be organized.

For example, let's consider the course of analysis of the lesson using the case study method when conducting laboratory work on the topic "Research of the chemical properties of saturated hydrocarbons" in the subject of organic chemistry taught in the 3rd year of higher educational institutions under the 6B01506-Chemistry educational program.

Table 1 – Lesson plan

Subject name	Organic chemistry
Lesson topic	"Study of chemical properties of saturated hydrocarbons"
Type of lesson	Laboratory lesson
Number of courses/students:	3 courses/18 students
Objective	Case SMART Objectives: S (Specific) - Students will summarize the isomerism and properties of saturated hydrocarbons. M (Measurable) - Consideration of what percentage of total organic compounds are natural sources of saturated hydrocarbons. A (Achievable) - Consideration of what percentage of total organic compounds are natural sources of saturated hydrocarbons. R (Realistic) - Students independently analyze this topic and summarize using the presented literature. T (Time bound) - 2 hours of lectures, 2 hours of laboratory work, 2 hours of practical training.

Responsibilities	Case Responsibilities: 1. Analysis of the situation; 2. Bringing the situation from life experience; 3. Learning to listen and evaluate other people's opinions; 4. Consider different ways to find a case solution; 5. Defense of the case decision; 6. Discuss the identified case solution and find the most effective one.
Necessary equipment and reagents	sodium, potassium acetate, sodium bicarbonate, bromine water (light yellow), potassium permanganate (diluted solution).
Reviewing of theoretical knowledge	*Basic questions:* 1. Homologous series, nomenclature and isomerism of saturated hydrocarbons. 2. Methods and use of saturated hydrocarbons. *Subject questions:* 1. Saturated hydrocarbons are characterized by substitution reactions. Write the steps of the methane chlorination reaction with a radical chain mechanism. 2. Write the equation for the butane nitration reaction using the Konovalov method. 3. Write the equation of the ethane elimination reaction and explain its mechanism.
Stages of creating a case:	1. Introducing students to the case materials and situation - 5 minutes. 2. Rules for determining the goals of case creation and performing tasks - 5th minute. 3. Finding one or more solutions to the situation - 5 minutes. 4. Listening to students' decisions - 10 minutes. 5. Comparison and discussion of students' decisions - 10 minutes. 6. Self-evaluation - 5 minutes. 7. Mutual assessment of case solutions - 5 minutes. 8. Providing feedback / reflection - 5 minutes.
Laboratory work progress	1-Situation. During laboratory work in organic chemistry, students collected methane and ethylene in a stoppered test tube with a short gas-conducting tube. Finally, a 10x12 cm rubber tube with a glass on the end is continued. A mixture of 1 part of any anhydrous acetate and 1 part sodium bicarbonate is placed in a dry test tube. Continue the gas-conducting tubes and fix the test tube horizontally. The mixture is first heated slowly and then strongly. It was necessary to put the gas-conducting tube in separate test tubes with bromine water and potassium permanganate, and observe the bromination and oxidation reactions of methane by looking at their colors. However, the result of the reaction did not show any color, and the result obtained by the student turned out to be wrong.
	2-Situation. Methane and ethylene are collected in a stoppered test tube with a short gas-conducting tube. Finally, we continue with a 10x12 cm rubber tube with a glass at the end. A few grams of a mixture of 1 part anhydrous acetate and sodium bicarbonate are placed in a dry test tube. Continue the gas-conducting tubes and fix the test tube horizontally. The mixture is first heated slowly and then strongly. Without stopping the heating, methane is collected in a test tube filled with water in a water bath. Remove the gas tube from the water and stop heating. The test tube is closed with our finger and brought to the flame. Methane was supposed to burn with a blue flame. However, the student did not collect the gas correctly and the flame did not turn blue. If we put a porcelain plate in the flame of hot methane, black spots of soot should not have appeared, but black spots of soot appeared.
	Problem questions: 1. During the experiment, bromination and oxidation reactions did not take place due to the lack of accumulation of methane gas, justify your answer. 2. What is the importance of punctuality during laboratory practice?

Case study evaluation criteria: Grade Evaluation criteria	Grade Evaluation criteria 90-100 points - expressing one's thoughts in scientific language; - to find a complete, accurate and correct answer to the question; - the student finds the answer by combining experience and theory. 75-89 points - the student has fully mastered the material; - uses theoretical material to solve the problem situation, but there are some errors in the content and form of the answer; -- the answer is generally correct or has some errors. 50-74 points - the student delivers the material in full, not in order; -- cannot prove his point; - did not fully understand the theoretical material. 0-50 points - the case problem has not been solved; -- did not master the theoretical material at all; -- does not know how to solve the case.

Students are divided into groups to prepare a group (or individual) answer to a question in the amount of time set by the teacher. Answers are made in each group (independently from other groups), and they are compared and processed. After that, the work of presenting those solutions to the whole group will be formalized. Sometimes a personal point of view is specially proved. Each group is assigned a leader - "speaker". As a rule, if the case is well-constructed, then the decisions of the groups will not be consistent with each other. Speakers of the groups present the common decisions of the groups to others and answer questions. The teacher organizes and directs the general discussion.

Results of the case:

Interpersonal:

- Effective communication;
- Group leadership.

Instrumental:

- Planning and control.

Subject:

- Execution of case tasks;
- Ability to find a solution to the problem;
- Accuracy and consistency of results.

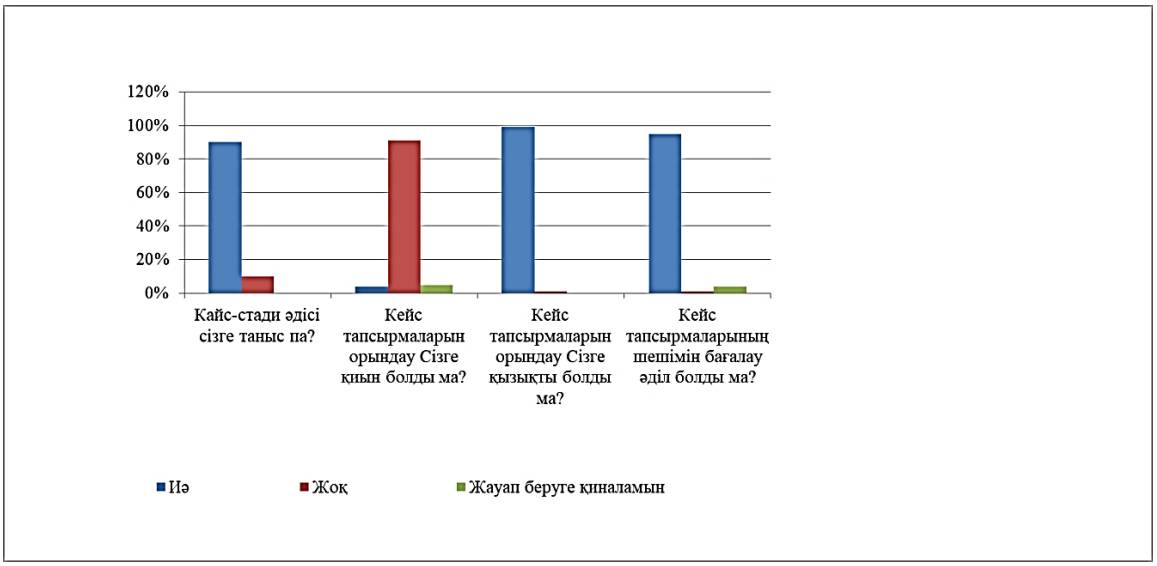
Conclusion (feedback):

- Did you like the lesson?
- What are the advantages of the lesson?
- Did you have any difficulties in mastering the topic?
- Do you think that what you learned today will be necessary for you in the future?
- What else would you like to know about this topic?

As we have seen from this lesson, he repeats and consolidates the knowledge acquired in the lecture by solving case tasks. During job analysis, learners learn to work collaboratively and independently.

Results and discussion

In the course of the research, a survey was received from 18 students studying in the 3rd year of the subject "Organic Chemistry" about the use of the case method. The results of the survey are presented in Figure 1.



Picture 1 – Students' opinion about the case study method.

Conclusion. The formation of creative communication skills of students, working in groups, as well as applying theoretical knowledge in practice, thinking critically and working with information showed that the case-study method is effective during organic chemistry laboratory classes. At the same time, students learned to express their thoughts freely, listen to others' opinions, pay attention to someone's opinion, and share what they know, giving specific arguments in solving problematic questions individually. In conclusion, it is necessary to emphasize that the method of case-study analysis is a method that trains students to quickly and efficiently think about unexpected situations and problematic issues, to use scientific theory and its cognitive methodology in practice.

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ОРГАНИКАЛЫҚ ХИМИЯНЫ ОҚЫТУДА CASE-STUDY ӘДІСІН ҚОЛДАНУДЫҢ ТИІМДІЛІГІ

Имангазинова Ж.С.

І.Жансүгіров атындағы Жетісу университеті, Талдықорған қаласы, Қазақстан
e-mail: gema.232@mail.ru

Мақалада жоғары оқу орындарында органикалық химияны оқытуда заманауи белсенді case-study оқыту технологиясын қолданудың тиімділігі, білімгердердің теориялық білімді терең меңгеріп, талдау, жинақтау, бағалау дағдыларын қалыптастырудағы алатын орны қарастырылған.

Тақырыптың мазмұнын ашу үшін 2021-2023 жылдар аралығында 6В01506-Химия білім беру бағдарламасында базалық және бейіндік пәндерді оқытуда кейс-технологияны қолдану арқылы білім алушылардың коммуникативті, іздемпаздық, шығармашылық, теориялық білімді іс жүзінде қолдану негізінде білімгерлердің арнайы пәндік және әмбебап пәнаралық құзіреттілігін қалыптастырудың тиімді әдістерін анықтау мақсатында жүргізілген эксперименттік-тәжірибелік зерттеу нәтижелері ұсынылған.

Мақалада органикалық химиядан зертханалық сабақтарда case-study технологиясын қолданылған кезде білім алушылардың креативті көзқарастарының қалыптасу тыңдалып, топта ойларын еркін жеткізу, дәрісте алған білім білік дағдыларын зертханалық сабақта тиімді пайдалану әдістері сараланған.

Кілт сөздер: *case-study, жағдаят, аналитикалық дағдылар, коммуникативті дағдылар, өзіндік саралау, SMART мақсат.*

ЭФФЕКТИВНОСТЬ ИСПОЛЬЗОВАНИЯ МЕТОДА CASE-STUDY В ОБУЧЕНИИ ОРГАНИЧЕСКОЙ ХИМИИ

Имангазинова Ж.С.

Жетысуский университет имени И.Жансугурова, г .Талдыкорган, Казахстан
e-mail: gema.232@mail.ru

В статье рассматривается эффективность применения современной активной технологии обучения case-study в преподавании органической химии в вузах, место, которое занимают обучающиеся в углубленном усвоении теоретических знаний, формировании навыков анализа, обобщения, оценки.

Для раскрытия содержания темы в образовательной программе 6В01506-Химия за 2021-2022 годы представлены результаты экспериментально-экспериментального исследования, проведенного с целью выявления эффективных методов формирования специальной предметной и универсальной междисциплинарной компетенции обучающихся на основе практического применения коммуникативных, поисковых, творческих, теоретических знаний обучающихся с использованием кейс-технологий в преподавании базовых и профильных дисциплин.

В статье проанализированы методы формирования креативных взглядов обучающихся при использовании технологии case-study на лабораторных занятиях по органической химии, свободного изложения мыслей в группе, эффективного использования полученных на лекции знаний и умений на лабораторных занятиях.

Ключевые слова: *case-study, ситуативность, аналитические навыки, коммуникативные навыки, самодифференцировка, SMART цель.*