SRSTI 78.21.14.
https://doi.org/10.56132/2791-3368.2025.1-60-11

G.G. Gullarli

Millitary Institute after Haydar Aliyev, Baku, Azerbaijan
(E-mail: axundzadegullu@rambler.ru)

The role of laboratory classes in teaching chemistry in military universities

In teaching chemistry, the question of sources of knowledge is very important. Since a cadet can gain knowledge either from the words of a teacher and a textbooks, or through direct familiarization with substances when performing experiments. The laboratory is the place where the connection between theory and practice takes place, it is a means for assessing knowledge, applying ideas and skills, and a place for interpreting one's findings and observations. The article describes a pedagogical experiment conducted at military institute during chemistry classes. In two experimental groups with the same number of cadets, classes were conducted using different modern technologies. According to the results of the experiment, it was revealed that the group using laboratory exercises obtained the best results.

Keywords: laboratory classes, pedagogical experiment, practice, chemistry, modern training.

Introduction

Currently, modern (interactive) training is a relevant concept in higher military educational institutions [1]. Today, cadets have full opportunity to obtain theoretical knowledge in all subjects, they have access to modern books and virtual libraries. But unfortunately, they often cannot properly combine the theory of some subjects with practice. Only in practice can one acquire skills based on theoretical knowledge, explain certain phenomena.

In teaching any subject, it is important to stimulate the mental activity of cadets. One of the main ways to comprehend the basics of a subject is an experiment.

Chemistry is an experimental-theoretical science. That is, each chemical theory is supported by a chemical experiment. An experiment is one of the main methods of mastering chemical science. The results of an experiment conducted by cadets make them think, draw a conclusion about the theoretical knowledge they have previously acquired. Only during laboratory classes can one acquire skills that help use the theoretical knowledge they have previously acquired and explain certain phenomena. It is important to consolidate the obtained material with an experiment before starting the subsequent material, since otherwise it will be more difficult for cadets to perceive new information.

The main goal of laboratory research is to consolidate the obtained material with a simple experiment. On many topics from the program of military universities teaching chemistry, you can do laboratory work.

The chemical laboratory in military universities is an independent laboratory equipped with all the necessary tools, chemicals, a distiller, electronic equipment, etc. Tables are installed that are convenient for cadets to conduct an experiment on their own. The teacher's table is located so that cadets can observe the reaction during the experiment. This happens in cases where expensive reagents were used during the experiment or if the experiment may be unsafe for health. The laboratory is also equipped with safety equipment, such as a fire extinguisher and a first aid kit.

In the practice of teaching chemistry, it is traditional to divide the experiment into a demonstration experience, practical work and experimental tasks. Demonstration experiments are carried out by teachers and laboratory assistants, or are demonstrated using media resources, videos and computers. Practical work is carried out to strengthen the students' chemical knowledge through independent chemical experiments by the students themselves [2]. It should be noted that when performing laboratory and practical work using traditional methods, cadets do not develop the ability to formulate the purpose of the work, plan and competently conduct an experiment, observe what is happening, record the results, describe what they saw and draw conclusions.

When performing experimental tasks or assignments, cadets not only reveal their theoretical and practical knowledge, but also demonstrate their logical thinking. Experimental tasks increase the level of reasoning and interest in science, and also develop ingenuity.

Research methods

To confirm the identified hypothesis, we conducted a pedagogical experiment. As research methods for studying the level of knowledge of cadets, the methods of testing, observation, questionnaires, qualitative and quantitative processing of the results of the pedagogical experiment were used [3]. The objective of the experiment is to show the relationship between chemical laboratory classes and theory, to develop the cognitive interest of cadets in the subject "Chemistry", to show interdisciplinary connections.

To conduct the pedagogical experiment, two experimental groups of 20 cadets were taken. When choosing, criteria with the same levels of knowledge were taken into account. Experimental tasks of a problematic nature were offered in both groups, in one after performing experiments of the corresponding practical work, and in the other immediately after theoretical classes.

When assessing the performance of experimental work, the handling of chemical reagents and laboratory equipment and glassware, accuracy and rational use of time were taken into account. Particular attention was paid to the accuracy of observation, correct determination and awareness of conclusions.

For clarity, the most effective and interesting experiments on the topics of "Oxidation-reduction reactions" and "Metals" were selected. For complete and

clear perception, a presentation with the conditions of the reactions and chemical equations of reactions was presented on slides, oxidation states for drawing up an electron balance were indicated.

To create feedback with the cadets, questions on previously studied topics were prepared. As a result, the cadets showed interest in the experiments and actively recalled the previously covered material.

Experiment. A zinc plate was lowered into a solution of copper sulfate $CuSO_4$. After some time, brick-red copper metal accumulates on the plate, and the solution changes color from blue to green. The same reaction can be carried out with an iron nail. The students are instructed to write the reaction equation and determine the type of reaction.

$$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu\downarrow$$
$$Fe + CuSO_4 \rightarrow FeSO_4 + Cu\downarrow$$

Using reactions as an example, the concept of oxidation-reduction reaction is explained and oxidation states are arranged together with the students.

Experiment. To a 1M NaOH solution, we add a 10% glucose solution and a blue indigo carmine solution. After some time after preparation, under the action of an aqueous alkali solution, glucose is dehydrated, turning into gluconic acid.

$$CH_2OH(CHOH)_4COH + H_2O = CH_2OH(CHOH)_4COOH + 2H^+$$

The indigo carmine indicator, adding hydrogen obtained from the reaction, changes color from green to red, then to yellow. That is why this reaction is called a "chemical traffic light" [4].

Experiment. A piece of copper is dropped into a flask with a concentrated solution of nitric acid. For interest, we took a copper coin of 0.05 manat. The coin dissolves with the release of a red-brown gas, and the solution in the flask turns green.

$$Cu + 4HNO_3(\text{конц.}) \rightarrow Cu(NO_3)_2 + NO_2\uparrow + 2H_2O$$

Experiment. In a flask, we prepare a solution of lead, in our case lead nitrate, and add acetic acid to prevent hydrolysis. To it, we add a solution of potassium iodide prepared in very hot water.

$$Pb(NO_3)_2 + 2KJ = 2KNO_3 + PbJ_2$$

Since the water is hot, the resulting precipitate of PbJ_2 dissolves. As the solution slowly cools, small crystals of "golden rain" fall out [5].

Research Results

For evaluation, the cadets were given a number of theoretical questions, problems and experimental tasks. Most of the cadets in both groups coped with the questions and tasks. However, the answers to the experimental tasks showed different results. The experimental group, which was present at the laboratory classes, gave detailed descriptions and explanations of the tasks, which increased the quality of the answers when evaluating the cadets. The average score of this group was 96 out of 100.

In the other group, many cadets had incomplete answers, which accordingly affected the evaluation. The average score of this group was 70 out of 100.

Such results, in our opinion, indicate a significant role of laboratory work, which was carried out in one of the experimental groups.

Conclusions

All of the above leads to the conclusion about the need for further improvement of the methodology of conducting laboratory classes, which are an important basis for studying chemistry in military universities, as well as the development and implementation of laboratory classes in the process of teaching chemistry.

Conducting even very simple chemical experiments helps in learning, simplifying the process of assimilation of the material. If the assimilation of the material is not perfect, then it will be difficult to achieve an understanding of the subsequent material, since in the absence of a connection with previous data, it is more difficult for cadets to think, in addition, their faith in scientific facts will weaken. Cadets lose interest in the subject, it seems to them that science is difficult to understand and the knowledge obtained during theoretical classes weakens, which is a disaster in education.

During laboratory classes, cadets have the opportunity to check the facts obtained in theoretical classes, satisfy their curiosity - all this increases the level of reasoning and interest in Chemistry. Laboratory work expands the cadets' opportunities to acquire skills and develops their creative qualities.

References:

1. Gyullyarli, G.G., Nasibova, L.E. (2023).Kejs-metod v obuchenii himii v voennyh VUZ-ah. [Case method in teaching chemistry in military universities]. / “Sciences of Europe”/ #120,– Praha: –P. 32-34.

2. Numonzhonova, D.SH. (2019). Rol' laboratorii dlya obucheniya himii. «Mirovaya nauka» [The Role of the Laboratory in Teaching Chemistry. "World Science"]. №9(30), –P. 172-175.

3. Glazkova, O.V. (1999). Formirovanie himicheskih znanij v processe provedeniya laboratorno-prakticheskih rabot v kurse himii srednej shkoly. [Formation of chemical knowledge in the process of laboratory and practical work in the chemistry course of secondary school]. Avtoreferat dissertacii na soiskanie kandidata pedagogicheskih nauk, -18 p.

4. Bahtiyarova, YU.V., Sirazieva, E.V., Rahmanova, A.R., Giniyatova, A.R. (2014). Himicheskij eksperiment – sredstvo obucheniya himii [Chemical experiment - a means of teaching chemistry]. Sbornik nauchnyh i nauchno-metodicheskih trudov. V Mezhdunarodnaya nauchno-prakticheskaya konferenciya, - Kazan: –P. 26-30.

5. Gyullerli, G.H._ Mamedova, N.G._ Imralieva, G.E. (2019). Neorganicheskaya himiya prakticheskaya. [Inorganic chemistry practical]. -Baku: -168 p.

Г.Г. Гюллярли

Әскери жоғары оқу орындарында химияны оқытудағы зертханалық сабақтардың рөлі

Химияны оқытуда білім көздері туралы мәселе өте маңызды. Курсант білімді мұғалім мен оқулықтың сөздерінен немесе тәжірибелерді орындау кезінде заттармен тікелей танысу арқылы ала алады. Зертхана - бұл теория мен практика арасындағы байланыс жүзеге асырылатын орын, бұл білімді бағалау, идеялар мен дағдыларды қолдану құралы және оның қорытындылары мен бақылауларын түсіндіру орны. Бұл мақалада химия сабақтары кезінде әскери институтта жүргізілген педагогикалық эксперимент сипатталған. Курсанттар саны бірдей екі эксперименттік топта әртүрлі заманауи технологияларды қолдана отырып сабақтар өткізілді. Эксперимент нәтижелері бойынша, зертханалық сабақтарды қолдану арқылы өткезілген топта ең жақсы нәтижелер алынғаны анықталды.

Кілт сөздер: зертханалық сабақтар, педагогикалық эксперимент, практика, химия, заманауи оқыту.

Г.Г. Гюллярли

Роль лабораторных занятий в обучении химии в военных вузах

В преподавании химии очень важен вопрос об источниках знания. Так как знания курсант может получить или со слов учителя и учебника, или же путем непосредственного ознакомления с веществами при выполнении опытов. Лаборатория – это место, где осуществляется связь между теорией и практикой, это средство для оценки знаний, применения идей и навыков и место для интерпретации своих выводов и наблюдений. В данной статье описывается педагогический эксперимент, проведенный в военном институте во время занятий по химии. В двух экспериментальных группах с одинаковым количеством курсантов были проведены занятия с применением разных современных технологий. По результатам эксперимента было выявлено, что в группе с применением лабораторных занятий получены наилучшие результаты.

Ключевые слова: лабораторные занятия, педагогический эксперимент, практика, химия, современное обучение.

Список литературы:

1. Гюллярли Г.Г., Насибова Л.Э. Кейс-метод в обучении химии в военных ВУЗ-ах. / “Sciences of Europe”/ #120, - Praha: - 2023. – С. 32-34.

2. Нумонжонова Д.Ш. Роль лаборатории для обучения химии. «Мировая наука» №9(30), - 201., -С.172-175.

3. Глазкова О.В. Формирование химических знаний в процессе проведения лабораторно-практических работ в курсе химии средней школы. /Автореферат диссертации на соискание кандидата педагогических наук, - 1999. - 18 с.

4. Бахтиярова Ю.В., Сиразиева Е.В., Рахманова А.Р., Гиниятова А.Р. Химический эксперимент – средство обучения химии / Сборник научных и научно-методических трудов. V Международная научно-практическая конференция, - Казань: - 2014, - С. 26-30.

5. Гюллерли, Г.Х. Мамедова, Н.Г. Имралиева, Г.Е. Неорганическая химия практическая. -Баку: - 2019. -168 с.

Гюллярли Гюлли Гусейн Али қызы	химия ғылымдарының кандидаты, доцент, Гейдар Әлиев атындағы Әскери институты ғылыми бөлімінің доценті, Баку, Әзірбайжан
Гюллярли Гюлли Гусейн Али кызы	кандидат химических наук, доцент, доцент научного отдела Военного института имени Гейдара Алиева, Баку, Азербайджан
Gullarli Gullu	ph.Doctor, associate professor, Millitary Institute after Haydar Aliyev, Baku, Azerbaijan