

USING METHODOLOGY VIRTUAL LABORATORIES IN TEACHING CHEMISTRY IN EDUCATIONAL INSTITUTIONS

Julboev Tulkin Abduvalievich

Senior teacher

Jizzakh state pedagogical university

<https://doi.org/10.5281/zenodo.10058850>

Abstract. *The organization and improvement of virtual laboratories in the teaching of chemistry in the higher education system will be highly effective. Experiments that can be performed in the virtual laboratories ensure that they are performed in the same way as in a chemistry laboratory training room. The sequence of exercises is based on strict rules and serves to strengthen theoretical knowledge. And experiments also in the virtual laboratories encourages a clear understanding of the essence of the training.*

Keywords: *education, continuous education, technical tool, computer program, animation, experiment, virtual laboratory, reagent, device*

INTRODUCTION

Based on the decision of the Cabinet of Ministers of the Republic of Uzbekistan dated December 31, 2020 "On measures to improve the system related to the organization of educational processes in higher education institutions", "Death in higher education institutions" "On the procedure for introducing the credit-module system into the educational process" basically, the credit-module system introduces a more perfect measurement unit of education into the higher education system of our country. According to him, each subject taught at the university is now reflected in credits depending on the amount of the study load. A student can accumulate a certain amount of credits in each semester and academic year, and depending on this amount, he will be awarded a bachelor's or master's degree.

In the ECTS credit-module system, the amount of one-year credits is 60 credits. Considering that one academic year consists of 2 semesters, a student will have to accumulate 30 credits in each semester during his studies. A bachelor's program is usually considered to be 4 years long, and a student is required to earn a total of 240 credits to earn this degree, and 120 credits to complete a master's program. [1]

The following advantages of training in the credit-module system are manifested:

- the level of academic freedom increases, independent choice of subjects, setting deadlines, choosing teachers.

- the increase of the share of independent education in the educational activity of students will be at least 50%.

- the creation of a developing environment in the teaching activities of teachers (advisory classes on science and modular, independent work of the student under the guidance of the teacher).

- reduction of the share of theoretical education and student's acquisition of measurable skills of practical knowledge and understanding, introduction of various interactive educational methods and modern technologies and technical tools, continuation of practical, laboratory training in independent education and criteria for evaluating them through specific types of activities.

Independent education is an important and integral component of the educational process, which is the ability of students to acquire independent knowledge, free theoretical and practical analysis of the subject, to have their own personal intellectual opinion on relevant problems and issues, scientific research. It is of great importance in the formation of the necessary knowledge, understanding and skills related to free thinking, the ability to develop conclusions and proposals on problematic issues and their implementation. The student's independent work is an integral part of the educational work specified in the educational plan for mastering compulsory and elective subjects. A certain part of the knowledge, skills and qualifications specified in the science program of the student's independent work on inorganic chemistry must be mastered by the student based on the advice and recommendations of the science teacher in the classroom and outside the classroom.

Currently, modern methods of teaching have been developed and are widely used in the educational process. The use of modern teaching methods leads to high efficiency in the teaching process. When choosing educational methods, it is appropriate to choose based on the didactic task of each lesson.

Organization of chemistry education on the basis of modular teaching technology, innovative technologies encourages students to increase their interest in science, to be active, to think critically, to independently master the educational material, to apply theoretical knowledge in practice. It is very important that students organize the process of learning chemistry and use it appropriately to serve as a powerful factor in improving the educational process.

LITERATURE ANALYSIS AND METHOD

An important vital factor that directly affects the formation of spirituality is closely related to the education system. It is known that our forefathers considered knowledge, education and upbringing as priceless wealth, as the most important condition and guarantee of human development and development of the nation. Of course, education is a product of consciousness, but at the same time it is the most important factor that determines the level of consciousness and its development, that is, it forms and enriches the spirituality of the people. Therefore, it is impossible to develop spirituality without changing the system of education and, on this basis, consciousness. Therefore, superficial, formal approaches and ill-thought-out work are absolutely unacceptable in this area [2].

Decree No. PF-6079 of the President of the Republic of Uzbekistan dated October 5, 2020 on the approval of the "Digital Uzbekistan-2030" strategy and measures for its effective implementation: Active development of the digital economy in our country, in all industries and sectors, first of all, it is indicated that comprehensive measures are being implemented for the wide introduction of modern information and communication technologies in public administration, education, health care and agriculture [2].

Decision PQ-4805 of the President of the Republic of Uzbekistan dated August 12, 2020 "On measures to increase the quality of continuous education and the effectiveness of science in the fields of chemistry and biology" education, science made it possible to implement major changes in the development of fields and the training of highly qualified personnel. The main priority of the State Program "Year of Science, Enlightenment and Digital Economy" is to ensure an effective educational process in the fields of chemistry and biology in higher education institutions, to achieve the integration of science and production, under the leadership of

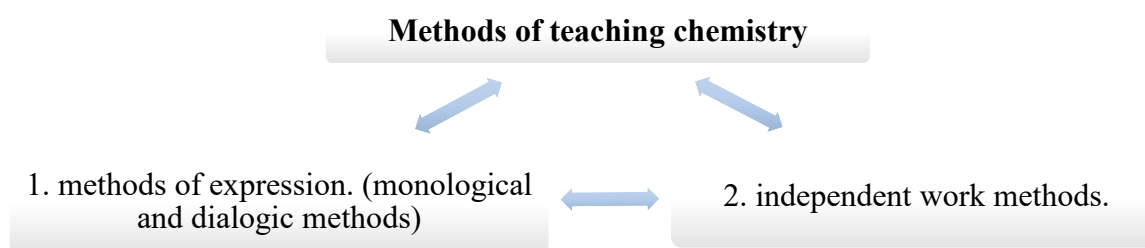
experienced experts in the field. pre-diploma internships, teaching students to use modern laboratory equipment and creating conditions for close acquaintance with production processes, assisting in the implementation of scientific work results and establishing cooperation in the commercialization of scientific developments [3]. Increasing attention to strengthening the material and technical base of school education, especially family educational institutions, has become the most important and serious issue on our agenda. Even today, the lack of reagents, devices and modern methodological recommendations in the chemical laboratory is clearly felt. In addition, chemical devices, which can be prepared by a chemistry teacher without difficulty, are purchased from various factories and enterprises at very high prices. Considering the fact that most chemical equipment and devices become unusable in a short time, the importance of the chemistry teacher's role is obvious [4].

Equipment and devices with a modern complex structure produced in factories and enterprises abroad and in our country are entering scientific laboratories as well as educational chemistry laboratories. A special feature of educational chemistry laboratory rooms is that the main attention here should be focused on understanding the process being studied. For this, it is advisable to use tools and devices with a simple structure that do not distract students' minds as much as possible.

The use of modern technical tools, including computer programs, opens up many opportunities for organizing a chemical experiment. With the help of computer programs, it is possible to learn the content of a chemical experiment in a short time, to get acquainted with experiments through animations even in the absence of reagents and tools [5]. The introduction and distribution of video recordings of experiments on mobile phones creates a number of new conveniences. In the course of a chemical experiment, performing calculations based on the formula with the help of an electronic program allows you to save time and get accurate results. In this regard, as a result of the improvement of the technical base of the educational institutions of our Republic, as well as the connection of computer equipment to Internet networks, the provision of electronic communications has increased. As a result of this, the introduction of new pedagogical and information technologies into educational institutions of the Republic, the use of new interactive methods and tools for the subjects included in the curriculum, including distance learning, holding computerized conferences, creating electronic textbooks and teaching them - increased attention to activities aimed at application in the educational process.

RESULTS

A chemistry student is required to explain the educational material himself, and to teach students to work independently. Based on this requirement, the methods of teaching chemistry are divided into 2:



1. The student's methods of presenting the educational material, including the use of lectures, lectures, conversations, excursions, demonstration experiments and other means of instructional teaching.

Monological methods - speaking, divided into lectures, the content of the educational material is explained by the student himself. In this method, students learn by observing and experimenting with facts: knowledge in science is demonstrated in the form of environmental protection, the occurrence of elements and substances.

When the explanation method is used, the essence of theoretical knowledge is revealed to the students. When the law of conservation of the mass of substances is explained from the atomic-molecular point of view, or when the periodic recurrence of the properties of elements is explained, the concepts are successively opened and generalized.

The lecture method is a monotonous method that takes a long time. School lectures take more than 30 minutes and are mainly used for high school students and students. In the monotonous method, the student pays great attention to the fluency of his speech.

A student should be able to attract the attention of students by explaining the material with fluency and purity of speech.

Dialogical methods - various conversations, seminars, for example, are conducted in the form of communicative speech between the student and the student.

Conversation is a dialogue between a student and a student.

The student answers the student's questions or vice versa.

2. Independent work methods - laboratory work, practical exercises, solving chemistry problems and working with literature.

The use of experiments is considered the most important method in teaching chemistry. The peculiarity of the subject of chemistry is that the theoretical content is not abstract, but evident at the same time. Demonstration experiment can be demonstrated by a student, a laboratory technician or a student and explained by a student. At the beginning of the course, when students have not yet developed the skills and abilities to perform chemical experiments, the student himself or the laboratory technician conducts them. Demonstration experiments are especially interesting when they become useful.

For example, demonstration of CO₂ firefighting;

Demonstrability - it is necessary to carry out experiments in such a way that all students can see them. It is necessary to make effective use of visual aids such as overhead projectors and other tools.

Experiences shown to students must be simple, safe, and reliable. The details of the experiment must be explained.

When conducting experiments, it is recommended to follow the following methods:

1. Knowing the purpose of the experiment: students should understand why the experiment is being conducted.

2. Drawing the drawings of the equipment used for experiments; determination of conditions, (in what conditions and environment the reaction is carried out)

3. Organization of students' ability to observe. (Understanding what is happening and what will be the result)

4. Ability to make theoretical conclusions; the developmental function of the experiment is realized by the teacher's words.

They are:

1) Emergence of knowledge from the experience itself.

2) The student fills in the observation of word comments.

The student's use of educational and demonstration tools in the process of teaching has a positive effect on chemistry education. They are: class board, various charts and tables, models, models, magnetic applications, screen manuals, etc. The classroom board plays the role of the most important tool. Formulas and equations related to the content of the lesson should be written using the blackboard effectively.

- The practical activity of students is based on oral-demonstration-practical methods. In this activity, the guidance of the student is definitely a guiding activity. Students' independent work is done in different ways. These forms are: team, group, individual. Their types are also different. M: Student experiment (laboratory experiments and practical training). Solving chemical problems, working with literature, performing creative tasks, (construction of devices, making models), performing control work, independent work are the most important areas of students' acquisition of new knowledge, formation of skills and abilities, and learning of science. The acquired knowledge, skills, and abilities will be effective if they are independently applied to the activity. Independent work fulfills tasks such as education and development of students.

The student's independent work is considered a source of knowledge with the application of knowledge and skills in the activity.

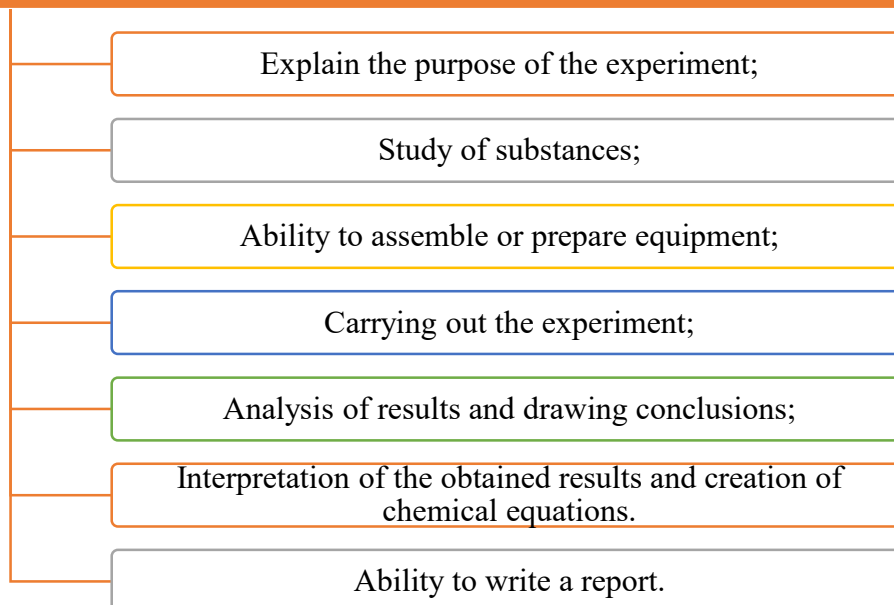
Student experiment is an independent type of work. In this way, the student tests the level of his knowledge and skills.

The purpose of the student experiment is to prepare him for the future independent life. Student experiment is divided into laboratory experiments and practical training.

They differ in didactic purposes.

Laboratory experiments are the acquisition of new knowledge and study of new material.

The student experiment is carried out in the following stages:



The student must understand the solution to the problem he has set before him.

Laboratory experiments of chemistry students are carried out individually, in groups, and as a team. Laboratory training places are allocated to students in advance.

Laboratory experiments are conducted in the process of explaining the content of new material.

Practical lessons – after certain topics are studied, they serve to strengthen, improve, summarize the acquired knowledge and improve skills and qualifications.

Practical training in chemistry is the main factor in the formation of knowledge skills of students. He pays great attention to the formation of skills and competencies in practical training. During each practical training, it is required to pay special attention to the technical rules of working with reagents, accessories and chemical equipment, handling skills, and to follow the rules of safety techniques. Practical training takes two forms: training based on given instructions and experiments related to solving experimental problems.

Instruction- experiments conducted on the basis of given guidelines. Each stage of the experiment will be given in writing. They are written in the textbook.

Experimental lessons - the condition of the problem is given without giving the instruction. Based on this condition, the student creatively performs independent work. When solving an experimental problem, following the rules of safety technology, the necessary reactive accessories are placed on the table.

At the end of the experiments, reports are written in a special notebook. Reports are kept in the chemistry room.

The form of the report may be as follows:

1) class. 2) student 3) science 4) topic of the work 5) name of the experiment. 6) the purpose of the experiment. 7) execution procedure. 8) equipment drawing and observation conclusions. 9) summary and reaction equations.

Requirements for the teaching method: A normally organized educational process requires the use of all available methods in chemistry, rather than a universal method.

Each method is selected depending on the content and general character of the educational material, the level and preparation of students, and the school (whether it has a chemistry laboratory or not).

In the teaching of chemistry, theoretical exercises and practical experiences are closely related to each other [16]. In such a situation, a number of foreign chemist pedagogues conducted experiments involving the virtual laboratory in the teaching of chemistry. Experiments that can be performed in the virtual laboratory ensure that they are performed in the same way as in a chemistry laboratory training room. The sequence of trainings is based on strict rules and serves to strengthen theoretical knowledge. With a number of experiments in the virtual laboratory, each repetition encourages a deeper understanding of the essence of the training. In addition, it saves materials necessary for training.[20] In order to improve the experimental material supply of the chemistry teaching process and its implementation, to create scientific and methodological developments on the basis of the virtual laboratory improvement of the chemical experiment, to eliminate these problems, it is envisaged to implement the following tasks:

- the role and position of the virtual laboratory in the science and educational subject in the chemical experiment is studied and analyzed;

- creating developments on the scientific and methodological issues of improving the virtual laboratory;

- organization and conduct of experimental tests to determine the pedagogical effect of relevant research results in connection with the introduction of the created developments into the higher education system;

In conclusion, it should be noted that the virtual laboratory is a programmed complex, which is used to perform chemical experiments without real substances or devices using a computer. Experience with such laboratory devices requires knowledge of computer technology, appropriate software, and its efficient use. It is very important to first program the virtual laboratory and deliver it to the user. The emergence of a virtual laboratory can be seen as the result of the cause and effect of some difficulties to bring some experiments to a real state. The advantage of the virtual laboratory over the real laboratory can be seen in the following.

- Save expensive reagents and devices;
- Preventing student danger;
- Computer equipment is also expensive, but currently this teaching in the field of education is very sufficient;
- Prepared virtual laboratory can be used for a long time;
- It is possible to carry out very difficult experiments in laboratory conditions;
- In the virtual laboratory, the mechanism of chemical processes at the level of small particles can be conveyed to students.
- We have the ability to show the changes that go slowly and vice versa for short-term experiences.
- Security. Injuries due to poisoning or electric shock, broken glassware are prevented.
- Experiments can be seen quickly and severally in the virtual laboratory.

Experiments that can be performed in the virtual laboratory ensure that they are performed in the same way as in a chemistry laboratory training room. The sequence of trainings is based on strict rules and serves to strengthen theoretical knowledge. By performing several experiments in the virtual laboratory, each repetition encourages a deeper understanding of the essence of the training and saves the necessary materials for the training.

CONCLUSION

The content of the educational process is the effectiveness of the level of knowledge that the teacher imparts to the student. Therefore, it is necessary for the teacher to have a deep understanding of the content and essence of the new pedagogical technology, based on it, to teach using new methods and methods.

Many professions in modern production require attracting not only educated people, but also people with highly developed creative abilities.

Solving the complex tasks of educating young people is crucially dependent on the teacher's ideological beliefs, professional skills, art, talent and spirituality. In fact, it is difficult to imagine the development of society and its future without teachers.

One of the primary tasks of teachers is to mobilize all available opportunities to organize the educational process in different ways.

Every pedagogue should always remember that the lesson is the main form of the educational process. All processes of modern education consist in teaching students to think independently and create independently.

REFERENCES

1. O‘zbekiston Respublikasi Vazirlar Mahakamasining 2020-yil 31-dekabrda “Oliy ta’lim muassasalarida ta’lim jarayonlarini tashkil etish bilan bog‘liq tizimni takomillashtirish chora-tadbirlari to‘g‘risida”gi qarori.

2. “Raqamli O‘zbekiston-2030” strategiyasini tasdiqlash va uni samarali amalga oshirish chora-tadbirlari to‘g‘risida. O‘zbekiston Respublikasi Prezidentining Farmoni, 05.10.2020 yildagi PF-6079-son.
3. O‘zbekiston Respublikasi Prezidenti Sh.Mirziyoevning “Kimyo va biologiya yo‘nalishlarida uzluksiz ta‘lim sifatini va ilm-fan natijadorligini oshirish chora-tadbirlari to‘g‘risi”da. 2020 yil 12 avgustdagi PQ-4805-son qarori.
4. O‘zbekiston Respublikasi “Ta‘lim to‘g‘risida”gi qonun. 2020 yil 23 sentyabr.
5. O‘zbekiston Respublikasi Prezidentining 2017 yil 20 apreldagi PQ-2909-sonli qarori: “Oliy ta‘lim tizimini yanada rivojlantirish chora-tadbirlari to‘g‘risida”gi qarori.
6. O‘zbekiston Respublikasining 2019 yil 29 oktyabr “Ilm-fan va ilmiy faoliyat to‘g‘risida”gi O‘RQ-576-son qonuni.
7. O‘zbekiston Respublikasining 2020 yil 24 iyulda “Innovastion faoliyat to‘g‘risida” gi O‘RQ-630-sonli Qonuni.
8. O‘zbekiston Respublikasi Prezidentining 2019 yil 8 oktyabr “O‘zbekiston Respublikasi oliy ta‘lim tizimini 2030 yilgacha rivojlantirish konstepstiyasini tasdiqlash to‘g‘risida”gi PF-5847-son prezident farmoni.
9. 2020 yil 29 oktyabr “Ilm-fanni 2030 yilgacha rivojlantirish konstepstiyasini tasdiqlash to‘g‘risida” gi PF-6097-sonli Farmoni.
10. O‘zbekiston Respublikasi Prezidentining 2019 yil 8 oktyabrdagi “O‘zbekiston Respublikasi oliy ta‘lim tizimini 2030 yilgacha rivojlantirish konstepstiyasini tasdiqlash to‘g‘risida”gi PF-5847-son Farmoni.
11. O‘zbekiston Respublikasining “Ilm-fan va ilmiy faoliyat to‘g‘risida”gi, “Innovastion faoliyat to‘g‘risida”gi Qonunlari hamda O‘zbekiston Respublikasida ilm-fanni 2030 yilgacha rivojlantirish konstepstiyasi.
12. В.Ўринов. Ўзбекистон Республикаси Олий таълим муассасаларида ECTS кредит-модуль тизими: асосий тушунчалар ва қоидалар. Қўлланма.Эл-юрт умиди жамғармаси ва Республика Олий Таълим Кенгаши билан ҳамкорликда. 2020 й. -64 б.
13. Усмонов Б.Ш., Хабибуллаев Р.А. Олий ўқув юртларида ўқув жараёнини кредит-модуль тизимида ташкил қилиш. Ўқув қўлланма. – Тошкент, ТКТИ, 2020. - 120 бет.
14. Каримова Д.Р.Кредит-модуль тизимида мустақил таълим [Матн]: услубий қўлланма. Д.Р. Каримова.- Тошкент: ООО "Complex Print",2021.-126 б.
15. Turdiyeva G.S. Kredit-modul tizimida talabalarning mustaqil ishlarini bulutli texnologiyalar orqali tashkil etish usullari [Matn].Monografiya.Buxoro:"Sadriddin Salim Buxoriy" Durdon, 2022.-116 b.
16. Raxmatullaev N.G., Omonov X.T., Mirkomilov Sh.M. Kimyo o‘qitish metodikasi (darslik). T. «Iqtisod-Moliya» 2013 y.
17. N.Muhamadiev Kimyoviy birikmalar tuzilishi va xossalarini matematik modellashtirish. o‘quv qo‘llanma. O‘zbekiston Respublikasi Oliy va o‘rta maxsus ta‘lim vazirligi - T.: Cho‘lpon nomidagi NMIU, 2016
18. T.N.Julboev, B.N.Babaev, M.M.Sultonov. Kredit – modul tizimida kimyo fanidan virtual laboratoriyalardan foydalanish asoslari. “Tabiiy fanlarning dolzarb masalalari” mavzusidagi III-xalqaro ilmiy-nazariy anjuman materiallari to‘plami. 12-may 2022 yil. II-bo‘lim. Nukus – 2022.

19. T.A.Julboev, M.M.Sultonov, K.Abduvalieva. Teaching Chemistry computer software to students of chemistry in pedagogical higher education institutions. European Journal of Research and Reflection in Educational Sciences. Vol.9 No.3, 2021. ISSN 2056-5852.
20. T.A.Julboev. Methodology of development of independent learning skills in forming the concepts of inorganic chemistry. Science and innovation international scientific journal volume 2 issue 7 july 2023.
21. <http://edu.uz>. O'zbekiston Respublikasi Oliy ta'lim, va va innovatsiyalar vazirligi.
22. <http://lex.uz>. O'zbekiston Respublikasi Qonun hujjatlari ma'lumotlari milliy bazasi.
23. <http://natlib.uz> – Alisher Navoiy nomidagi O'zbekiston Milliy kutubxonasi.