Problem situations as a means of improving experimental knowledge in the process of teaching chemistry in secondary schools

Zulfiya Bekturganova1*, Atabek Kaipbergenov2, Erekeyeva Abadan1, and Bekmanova Gulbahar3

1Nukus State Pedagogical Institute, A. Dosnazarov ko'lishi, Nukus, Uzbekistan
2Nukus Mining Institute at the Navoi State Mining and Technology University, 27 Galaba Str., Navoiy, Uzbekistan
3Medical Institute of Karakalpakstan, Nukus, Republic of Uzbekistan, A. Dosnazarov ko'lishi, Nukus, Uzbekistan

Abstract. This article discusses the methods of teaching chemistry in secondary schools, a means of improving the formation of students, the main tasks of teaching chemistry, experimental knowledge, the immediate level of knowledge, a search heuristic conversation that activates the concepts and education system of students in the study of chemistry. Key words: problem-based learning, education requirements for creatively active students, exploratory conversation, problem-solving educational problems.

1 Introduction

Currently, society often finds itself in situations where we face difficult tasks. It is because of these difficulties that we understand that in the world around us there are still many facets unknown to us. Consequently, people need a deeper knowledge of the world around them, new processes, properties are constantly being discovered, relationships between people are being known. Thus, the creation of a culture of intellectual activity of students has always been and remains one of the main educational and general educational tasks. The development of intelligence is an important aspect of the preparation of the younger generation. His success should be achieved, first of all, in the classroom, when the teacher is left alone with his students. And the interest of students in learning, their direct level of knowledge, readiness for constant self-education, that is, their intellectual development, which convincingly proves modern psychology and pedagogy, depends on his skills in organizing activities. Many researchers and educators believe that the development of creative and intellectual abilities of students cannot be formed without the help of problem-based learning. Although this problem is considered in detail in the psychological, pedagogical and methodological literature, it has not received due attention in the practice of the school. Therefore, this topic was chosen for research in the final qualification work. The object of research is the process of teaching chemistry in an educational school. The subject of the research is a problematic approach to teaching chemistry. The purpose of the work is

* Corresponding author: ziyonetvilly@gmail.com
to study the use of problem-based learning in chemistry lessons at school. The hypothesis of
the study is that the use of problem-based learning contributes to the formation of cognitive
activity in the study of the subject.

2 Methodology

Problem-based learning is an actual way of learning that meets the requirements of the
education of creatively active students. This is a significant means of improving the formation
of students and a type of developmental education, in which the independent search activity
of students is in harmony with the assimilation of ready-made results. Problem-based
learning stimulates the student to search activity, develops his creative thinking, the student
is systematically involved in the search for solutions to new problems, forms mental activity.
The student does not become a listener, but is actively involved in the discussion process, he
becomes a researcher.

The main task of teaching chemistry is to develop students' knowledge to independently
perform all parts of problem-based learning: from posing a problem situation, choosing an
adequate method for resolving it, to assessing, self-control; executable activities executable
activities in general. Consequently, according to the recommendations of psychologists, we
begin to create experimental knowledge, starting from the control of implementation: actions
of others to the control of our own, which contributes to the formation of mental knowledge
of students, the development of one of the stages of the implementation of problem-based
learning. Action two; which must be transferred to the students themselves for independent
functioning; is an estimate, i.e., establishing the mastery of educational education, the
universal method for the implementation of a chemical experiment.

2.1 Three methods of problem-based learning are especially effective

First. Problem presentation (monologic presentation) is effective when students do not have
a satisfied amount of skills, when they encounter one or another phenomenon for the first
time and cannot establish the necessary connections. It is characterized by students'
perception of the material. The teacher himself creates problem situations and solves learning
difficulties. Students are only able to perceive the material. In this case, the search is carried
out by the teacher himself. This is the lowest level of concern.

Second. Search conversation (dialogue presentation) - in the process of conversation,
students, relying on the skills already known to them, under the guidance of a teacher, seek
and independently find the result on the problematic task question posed. It is characterized
by a dialogue between a teacher and a student in the process of a common solution of
educational problems. The teacher asks problem questions and offers tasks and other forms
of solution. This is the average level of difficulty.

Third. Independent and exploratory activity of students is the highest form of
independent activity and is permissible only when students have the knowledge necessary to
build scientific assumptions, and also the knowledge to make guesses, students are as active
as possible in the process of setting and solving educational problematic tasks.

The theory and practice of problem-based learning are considered in a huge number of
works in the psychological, methodological and highly specialized areas. Many scientists
suggest that the formation of students' creative abilities is unrealistic without the use of
problem-based learning. Creativity is realized through problem activity.

Main part. To organize a successful learning process, the student must decide why he
needs to learn, what it means to learn. To form the need to learn means to provide the child
with personal cognitive activity. Intrinsic motivation is the key to the triumph of the
educational process.
In the system of the educational process, the student must acquire different knowledge. By knowledge, I understand the implementation methods learned and become the personal heritage of the student. The use of problematic task situations in chemistry lessons, actions allows you to organize the process of mastering the basic ideas, laws in such a way that this knowledge becomes a tool for learning, and not a set of difficult incomprehensible words.

In this regard, in real time, the idea of its humanization is recognized as one of the leading trends in improving chemical education. The latter assumes not only the control of the individual-personal nature of the student, his needs and interests, but also determines the need for production in teaching the conditions for his self-determination and self-realization as a person. At the same time, the very nature of the organization of education changes: it is built as a joint search activity of the teacher and the student, aimed at comprehending the secrets of the science being comprehended by the student in the process of solving a number of educational problems.

The problem situation is the main element of problem-based learning, with the support of which the thought, the cognitive need of students are awakened, and thinking is activated. Depending on the location of the educational material, the psychological and age characteristics of students, different methods of producing a problem situation are distinguished.

In chemistry lessons, three methods of organizing problem activities are especially effective: problem presentation, heuristic conversation, and independent search research activity of students.

Problem presentation is useful when students do not have satisfied skills when they first encounter a question. In this case, the search for truth is carried out by the teacher himself. For example, when studying the main classes of inorganic substances, it is advisable to consider previous theories, point out their significance and shortcomings. Thus, the teacher does not simply notify the main provisions of the theory, but reveals the path that led to these results. The teacher, with a problematic presentation of the material, directs the cognitive process of students, poses questions that force them to think about the objections of the phenomenon.

As noted above, problem presentation is used if the student does not have a satisfied amount of skills. But if there are some minimum necessary skills to rationally apply heuristic conversation.

A search heuristic conversation is conducted with the help of a problem situation created by the teacher. At the same time, students independently outline the search path, put forward various guesses, put forward solutions. For example, when teaching the topic “Acids”, it is rational to start the lesson by solving a proportional problem for the recognition of substances: hydrochloric and sulfuric acids. We create circumstances for a problem situation: What color does litmus, methyl orange and phenolphthalein have in acid solutions?

The knowledge of students that, from the point of view of the theory of electrolytic dissociation, acids are electrolytes that, during dissociation, form hydrogen cations and anions of an acid residue, and this suggests that litmus and methyl orange change color in an acidic medium - the solutions become red and pink. Phenolphthalein remains colorless in acid medium. Students give their guesses. The solution of the problematic problem occurs in the process of studying the essence of electrolytic dissociation.

Conversation prepares students for independent study. This type of problem-based learning is acceptable if the student has a great knowledge of the subject. The problematic question is no longer formulated by the teacher, but by himself. Reading additional literature, the student himself comes to the problem: why so, and not in another way? Having posed a problematic question, he begins to look for an answer to it, puts forward conjectures, makes assumptions, for this, work is carried out to collect facts, their theoretical review and summation.
Many chemistry teachers notice that it is much more difficult to work on the development of students' research skills than to conduct a lesson according to an explanatory and illustrative plan. Problem-based learning requires more time than ordinary presentation of the material. Students are required to possess a certain erudition, since the lack of skills will not allow them to discuss the problem posed and look for methods to solve it. The teacher must be flexible and operative in the lesson in order to lead the student to the solution of the problem.

However, the superiority of this approach is obvious: the students acquire the skills of independent work, the majority increases the level of meaningfulness of the chemical finding when performing certain tasks; the number of students who understand how to perform any action and who are able to explain and justify its implementation is increasing.

Thus, the work on the formation of a research culture among students (with its consistently competent implementation) has a positive effect on the assimilation by students of all the components of finding a chemical education: knowledge, skills and abilities (methods of activity), skill of creative activity and skill of emotional and value attitude to the world and understanding of chemistry.

3 Results and discussions

The main goal of using interactive methods in teaching is to involve students in the process of active learning, develop their knowledge and research skills, and increase their interest in science. Interactive methods represent an active relationship between teacher and student, and is based on a complete understanding of one. The main purpose of introducing these methods into the educational process is to organize cooperation between the teacher and the student in the classroom. The teacher must involve students in the actual problems in the lesson, activate their movement and, as a result, ensure their assimilation. The use of the "Problem Situation" technology can be effective in developing students' free thinking skills in chemistry lessons. Because each subject of this subject is full of problematic issues. The purpose of using the technology of "problem education" is to teach students to be able to correctly find solutions to various problematic issues or situations, based on the topic of the subject, and to understand the essence of the problem is to form identification skills. And also introduce some methods for solving problems and teach the right choice of methods suitable for solving the same problem. At the same time, the teacher pays attention to the correct identification of the causes of the problem and actions to eliminate them.

When using this educational technology, the teacher explains to students the rules and requirements of the learning procedure, that is, that learning is phased in nature and that each stage requires their attention; in the learning process, he talks about working in small groups. and as a team in the audience. A lesson started in this way helps the students to be ready for the assigned tasks and arouses the interest of the students in their implementation. After that, the training process begins.

The technology of problem-based learning depends on the content of the educational material. This can be seen in the study of chemical reactions, rules, laboratory work and theories. Problem-based learning of chemical phenomena in the educational process can be organized as follows:
The technology of problem-based learning depends on the content of the educational material. This can be seen in the study of chemical phenomena, laws, practical experiments and theories. Problem-based learning of chemical phenomena in the educational process can be organized as follows:

1. Observation of a chemical phenomenon and determination of its characteristic features.
2. Establishing a connection between observed chemical phenomena and other previously studied chemical phenomena and highlighting their similar or different aspects.
3. Consider how chemical phenomena can be used in practice, and suggest ways to apply them.

The method of problem-based learning can be used at all stages of the study of chemical phenomena. But the possibilities of problem-based learning open up primarily in determining the essence of the phenomenon. As an example, consider the problematic teaching of electrolysis. To do this, first of all, you need a “basic” experience that clearly shows its main essence. As such an experiment, an experiment can be obtained showing that an electric current passes through an electrolyte solution, and an electric current does not pass through a pure crystalline substance or distilled water.

The main feature of the phenomenon is clearly visible from the experiment: firstly, there is no change in the electrodes when an electrolyzer containing a crystalline substance or distilled water is connected to a direct current source, and secondly, when an electrolyzer containing electrolytes is connected to a direct current source, no change in the electrodes occurs, i.e., separation of cathode and anode substances is observed. At first glance, the task is to determine the causes of the observed phenomenon, that is, the absence of an electric current in a crystalline substance or distilled water - the absence of a change in the electrodes and the passage of an electric current in a solution - the separation of substances in the electrodes, i.e., cathodes and anodes. So, the first problem arose. The discussion of the situation is as follows.

Teacher: “First of all, let us ask ourselves the question: why does not an electric current arise in a crystalline substance or distilled water?”

Students: due to the absence of free charge carriers in crystalline matter or distilled water.

Teacher: Let's find the reason why the vine appears when salt is added to distilled water.

Students: The main reason for this is the formation of negative and positive ions when salt dissolves.

Teacher: “How in our experiment substances are formed on the electrodes, i.e. cathodes and anodes? This question forces students to think again.

Thus, the following questions are put in the form of tasks and the meaning is revealed in cooperation with the students.
4 Conclusion

As a result of educational processes organized on the basis of "problem learning" technology, students learned that before finding a solution to a problem, it is necessary to determine its causes, that is, it is necessary to look for a relationship between cause and effect, and then study and eliminate them, they realize that they need to choose methods and techniques and clearly define their actions in solving the problem. Problems solved in this way will remain in their memory for a long time. In the future, this will help them work more meaningfully and meaningfully when studying new chemical phenomena. Students learn to think independently, creatively, critically and logically. By forcing themselves to think, they learn to solve a problem situation on the basis of life and practical tasks. Encourages organization, develops the ability to listen to other people's opinions and convey their own when working in a group.

References

1. V.V. Davydov, Problemy razvivayushchego obucheniya: Opyt nazariyasi va eksperimental psixologiya issledovaniya (Pedagogika, M., 1986)
2. E.D. Dneprov, Chetvertaya shkolnaya tuzum Rossiyada (Interpraks, M, 1994)
3. L.S. Vygotskiy, Pedagogicheskaya psixologiya (Pedagogika, Moskva, 1991)
4. L.S. Vygotskiy, Umstvennoe razvitie detey v protsessse obucheniya: sbornik statey (Gosudarstvennoe uchebnopedagogicheskoe izdatelstvo, M.-L., 1935)
5. V.V. Davylov, O ponatii razvivayushchego obucheniya: sb. Statey, Sib. in-t razvivayushchego obucheniya (Peleng, Tomsk, 1995)
7. N.A. Menchinskaya, Problemy ucheniya va umstvennogo razvitiya shkolnika: izbrannye psixologiya truddi (Pedagogika, Moskva, 1989)
8. Z.A. Reshetova, Process usvoeniya kak deyatelnost Sbornik izbrannyx trudov Mejdunarodnoy konferentsii «Sovremennye problemy didaktiki vysshey shkoly» (DonGU, Donetsk, 1997)
9. B.G. Meshcheryakov, Bolshoy psixologicheskiy slovar (Praym-EVROZNAK, SPb,
11. N.A. Mixaylovskaya, Problemy sovremennoy nauki i obrazovaniya 6(36), 190-192 (2015)
15. O.S. Gabrielyan, Ximiya v shkole 2, 16 (2013)