

The Use of Information Technologies in Teaching Solving Problems Related to The Main Class Compounds of Inorganic Substances at School

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Article History	Abstract
Received: 06 June 2023 Revised: 05 Sept 2023 Accepted: 01 Dec 2023 CC License CC-BY-NC-SA 4.0	<i>In this article, the use of information technology in teaching chemistry in schools to solve problems related to the main class compounds of inorganic substances: "Chemistry: for schoolchildren (use of interactive method in teaching solving problems related to the main class compounds of inorganic substances using the proportion method) the results of using self-education" electronic publication (EP) are highlighted. In the study "Chemistry: for schoolchildren (using an interactive method in teaching solving problems related to the main classes of compounds of inorganic substances using the method of proportions) self-education" electronic publication (EP), chemistry in the context of the use of information technologies teachers' activity, analysis of normative documents, observation, analysis of personal experience, interviewing, questioning, analysis of received data were used in teaching problem solving. As a result of the research, the use of the electronic publication(EP)"Chemistry: for schoolchildren (the use of interactive methods in teaching solving problems related to the main class compounds of inorganic substances using the proportion method) self-education" in schools students learn the basic concepts and laws of chemistry, get acquainted with the notation system, understand quantitative relationships between reactants, gain experience and develop practical skills. According to the results of the survey I liked working - 90%. 2. I did not like to work - 3% 3. The idea did not work - 7%. This assumption was later confirmed experimentally. In conclusion, the use of the electronic publication (EP) "Chemistry: for schoolchildren (use of interactive method in teaching solving problems related to the main classes of compounds of inorganic substances using the method of proportions) self-study" facilitates students' assimilation of the studied material, helps to develop and strengthen the skills of solving typical problems, forms chemical thinking in students, creates new opportunities for information transfer.</i> Keywords: Chemical Problem, Electronic Publication (EP), Self-Education, Information Technology, Main Classes Of Inorganic Compounds, Oxide, Acid, Base, Salt.

1. Introduction

In accordance with the laws "On Education" and "On the National Program of Personnel Training", to ensure the continuity and consistency of the teaching of general education subjects, to create a modern methodology, to develop and implement a new generation of state educational standards. for the purpose of organization, the Law of the Republic of Uzbekistan dated September 23, 2020 "On Education" № O`RL-637 was adopted [1]. In each of these documents, directions for the development of education in our country are indicated, priority tasks for its stages are defined. Science education has always taken a leading place in the processes of education, upbringing and development of students. Its important component is chemical education, and it is impossible to improve its effectiveness and quality without students acquiring the skills to master the methods of solving chemical problems. [2]. It is impossible to fulfill the assigned tasks without using new methods and educational tools, in which the information technologies of education play an important role. Their use expands the possibilities of information

exchange, new forms of education appear, the assimilation of knowledge by students is activated, and qualitatively new opportunities for learning and self-education appear [3].

Learning to solve chemical problems has always been given great importance. In programs that can be led by the teacher, a systematic approach to teaching problem solving is defined, their regular implementation allows forming chemical thinking in students [4]. However, the small number of hours allocated to studying chemistry, the lack of intrinsic motivation in most schoolchildren to learn to solve chemical problems, and a number of other reasons do not allow this approach to be implemented, at least for typical problems from chemistry. It is not guaranteed that they will acquire and develop skills in solving problems. As a result, most students' approach to learning to solve chemical problems is formal. If they do not master one type of problem or solution, they are forced to move on to another material. They perceive the next type of issues as something completely new and unrelated to what was previously known. As a result, a significant part of students will not form a general approach to solving chemical problems and will not have the ability to solve them.

Due to the ongoing reforms in the education sector, this situation may worsen. Undoubtedly, it will not be possible to change the situation for the better in the near future without using new textbooks for solving problems in chemistry and without developing a methodology for their application. Information technology is playing an increasingly important role in the organization of chemical education. The use of information technology in teaching chemical problem solving is one of the possible ways out of this situation, it allows to expand the worldview of students, new opportunities for information transfer, wider use of visual aids, interactive education. lim mode, combined with individualization of education and student activity. Solving problems has always been considered important in teaching chemistry, with the help of problems, students learn the basic concepts and laws of chemistry, get acquainted with the notation system, understand the quantitative relationships between reactants, experience acquire and develop practical skills. Pupils develop chemical thinking, the ability to achieve independent results in solving emerging problems, and an active life position is formed [5].

In this article, the use of information technology in teaching solving problems related to the main classes of compounds of inorganic substances: "Chemistry: for schoolchildren (use of an interactive method in teaching solving problems related to the main classes of compounds of inorganic substances using the proportion method) self- one of the possible methods of teaching to solve chemistry problems with the help of an electronic publication(EP)is offered. In our research, we relied on the works of V.V.Davidov [6], D.B.Elkonin [7], which consider the issues of theory and developmental education, and the psychological works of L.S.Vygotsky [8]. Methodist chemists O.S.Zaitsev [9], E.A.Alferova, E.Yu.Ratkevich, G.N.Mansurov [10] and others considered the technique of using computer educational programs in studying some topics of the chemistry course.

Scientists who developed various directions in the field of chemistry teaching methodology defended the idea of the need to introduce and widely apply issues to the educational process. We can mention among them: V.N. Verkhovsky, Yu.V. Khodakov and others. The use of problems in teaching chemistry is considered in the works of G.L.Abkin, V.N.Daineko, V.V.Eremin, E.G.Zlotnikov, R.G.Ivanova, N.E.Kuzmenko, N.E.Kuznetsova, M.S.Pak, G.P.Xomchenko, S.E.Chernobelskaya, E.A.Shishkin and others.

All researchers came to the conclusion that in order to learn to solve problems, it is necessary to master the methods of solving them, therefore, the main form of education is independent work [11].

The educational process can be effective only when it is rationally organized and students have sufficient knowledge, skills and competences for independent learning, as well as good educational tools. It is also important how skills, competences and didactic tools are used, only this knowledge becomes the property of the student after his independent mental work. Currently, it is important for teachers to prepare electronic publications (EP) to support the educational process and self-education at various stages of learning chemistry [12]. The computer is a powerful educational tool that can be used much more widely in the educational process to teach different forms of activity. The above makes the development of electronic publications and resources (EPR) and, most importantly, their application methods [13] relevant. The development of the methodology of its use and application will to some extent eliminate the contradictions that exist in the practice of teaching to solve chemical problems:

- the presence of many electronic publications intended for studying chemistry and the lack of problem-solving teaching functions in them;
- the possibility of practical use of electronic publication(EP)in teaching solving problems in chemistry and insufficiently developed methodology of their use;

- the need for students to independently solve complex chemical problems, the absence of a significant part of the ability to solve even the simplest problems;
- increase the possibilities of using electronic publication(EP)for teaching problem solving; that most teachers are not ready to use them in the educational process.

The identified contradictions determined the topic of the research: "Methodology of teaching students to solve chemical problems using information technologies", the use of information technologies in teaching solving problems related to the main classes of compounds of inorganic substances: "Chemistry: for schoolchildren (Using an interactive method in teaching solving problems related to the main classes of compounds of inorganic substances using the method of proportions) using self-education» electronic publication(EP)

The use of information technology in the teaching of solving problems in chemistry facilitates the mastery of the studied material, helps to develop and strengthen the skills of solving typical problems, to form chemical thinking in students, as a result, it activates their mental activity and the power of acquiring knowledge and increases the quality.

2. Materials And Methods

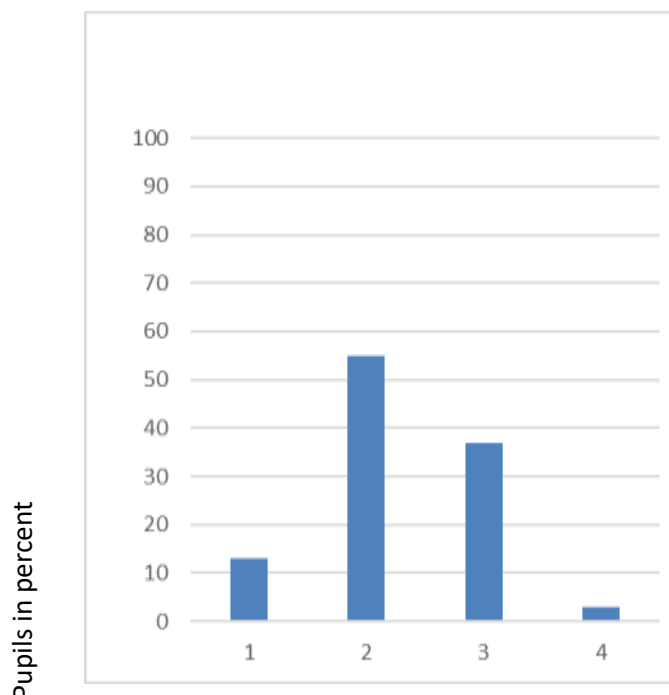
Methodological developments of the 7th classteachers of schools №17 and №23 of the Republic of Karakalpakstan on the teaching methodology, the methodology of teaching students to solve chemical problems with the help of information technologies, "Chemistry: school education" for students (using an interactive method in teaching solving problems related to the main classes of compounds of inorganic substances using the proportion method) self-education" electronic publication (EP), in teaching solving chemical problems in the conditions of using information technologies to gain pedagogical experience with the activity of teachers, analysis of normative documents, observation, analysis of personal experience, interviewing, questioning, analysis of received data.

3. Results and Discussion

The program of the subject "Chemistry" for general educational institutions is based on the requirements for the results presented in the general secondary education program. Law № O'RL-637 of the Republic of Uzbekistan dated September 23, 2020 "On Education" "Collection of legal documents of the Republic of Uzbekistan", September 28, 2020, 37-38 - number, Article 419 [1]. In Uzbekistan, the study of "Chemistry" starts from the 7th class, the volume is 68 study hours per year (2 study hours per week). In the 7th class, students study general chemistry. The course covers the basic concepts of chemistry, the structure of substances, the main classes of inorganic substances, oxides, acids, bases, salts, etc. In the 8th class, 68 study hours per year are allocated for studying chemistry (2 study hours per week); schoolchildren will learn about the general properties of chemical elements, chemical bonds, metals, etc. in the D.I.Mendeleev table. In the 9th class, 68 study hours per year (2 study hours per week) are allocated to study chemistry. The course covers electrolyte dissociation, carbon group elements, metals, and more. In the 10th class, 68 study hours per year (2 study hours per week) are allocated to study chemistry. The course includes the study of the theory of the structure of organic compounds, saturated hydrocarbons, unsaturated hydrocarbons, aromatic hydrocarbons, natural sources of hydrocarbons, alcohols, phenols, aldehydes, ketones, carboxylic acids, esters, carbohydrates, amines, amino acids, proteins, heterocyclic compounds. . In the 11th class, schoolchildren are allocated 68 study hours per year (2 study hours per week) to study chemistry. In the course, they will continue to learn about the structure of matter, periodic law, electrolyte dissociation, solutions, reaction rates, chemical equilibrium, oxidation-reduction reactions, electrolysis and their general laws. In specialized schools, 7-8-9 classes are allocated 136 hours per year (4 study hours per week), 10-11 classes are allocated 204 hours per year (6 study hours per week). The work programs of the study course are developed based on the chemistry course syllabus for the respective class. Textbooks for classes 7-8-9-10-11 are authored by I.R.Askarov, K.G'.Gopirov, N.X.Tukhtaboyev, A.Mutalibov, E.Murodov, S.Masharipov, H.Islamova Republic of Uzbekistan "YANGIYUL POLIGRAPH SERVICE " publishing house and publishing house of the Publisher and Information Agency named after Gofur Ghulam.

The existence of a wide variety of manuals containing recommendations for solving problems [14]. Analysis of literature sources [15] showed that the problems faced by students and teachers in teaching chemical problem-solving methods have been relevant for at least 35 years and are currently not fully resolved. The results of the entrance exams to some medical universities show that only 20-30% of school graduates can complete the entrance exams. Existing textbooks cannot fully solve the problem of teaching students how to solve them . They are not mobile enough, they require a large amount of knowledge when working, and some students cannot even solve simple (typical) tasks in chemistry [2]. A survey was conducted to determine the problems of schoolchildren in learning chemical sciences.

The results of the experiment on conducting the unified state exam in schools №17 and № 23 of the Republic of Karakalpakstan showed that 20-30 % of the students were able to solve the tasks in chemistry. During the experiments, students of the 7th class of the schools took part, they were offered "Questionnaire 1". It was found that 98% of the students noted that there were difficulties in solving chemical problems, only 2% believed that they did not have any difficulties. Inability to solve simple problems results in students not being able to solve more complex and combinational chemistry problems. The data obtained and our observations suggest that solving chemical problems is still not the leading method of acquiring knowledge and improving skills for the majority of students. Many school graduates and school students have difficulty solving simple problems, not to mention more complex ones. Indicator of the distribution of students' answers to the second question of "Questionnaire 1" about the difficulties encountered in solving chemical problems. (Picture-1).



Picture 1. According to the results of the survey, categories of students who have difficulty in solving chemical problems: 1. Any task. 2. Certain assignments. 3. The most difficult tasks. 4. There will be no difficulties.

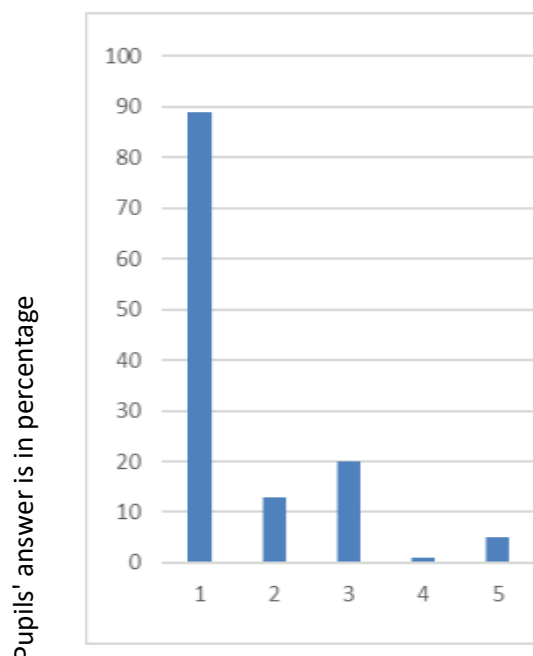
Student responses indicated that 13% had difficulty solving any chemical problem. In fact, students in this category cannot do any problems in chemistry. 55% of respondents find it difficult to solve certain types of problems. (I'm talking about the typical, simplest problems.) 37 % of respondents said they have difficulty doing the most complex problems. So, the students who gave such an answer perform multiplication tasks much better. If the problem is a little more complicated or new information is introduced, they lose the ability to work on the problem and cannot solve the problem independently. There are several reasons why most students lack problem-solving skills, here are just a few:

- the teacher does not have enough study time to teach students how to solve them using traditional methods;
- weakness of motivation, not only to solve chemical problems, but also to study chemistry in general.
- lack of deep theoretical knowledge of chemistry among many students;
- the need to combine knowledge from chemistry, physics, mathematics to successfully solve chemical problems;
- solving episodic problems in the process of learning chemistry, insufficiently evaluating the role of chemical problems for learning and development of students.
- a wide variety of issues, even more variety of ways to solve them;
- the impossibility of developing a single algorithmic recipe for solving various problems.

The list can be continued. At the same time, students consider problem-solving skills to be important to them, with 35% confident that their chemistry problem-solving skills will be used in their future careers. About 40% of students believe that problem-solving ability is an objective indicator of the quality of

preparation in chemistry, 33% believe that solving chemical problems promotes independence in learning and development of skills

We were interested in the question of how students learned to solve problems in chemistry. The obtained data showed that almost 89% of the respondents learn to solve problems in the classroom with the help of the teacher's explanation, 13% of the students turn to their friends and ask classmates for help when they face problems and difficulties, 20% of the textbook prefer to learn how to solve problems using, 5% turn to tutoring services, and none of the students ask to use educational computer programs to learn how to solve problems (Picture. 2) (Total 100% than kata, because students gave several answers).



Picture 2. *Tools used in teaching problem solving*

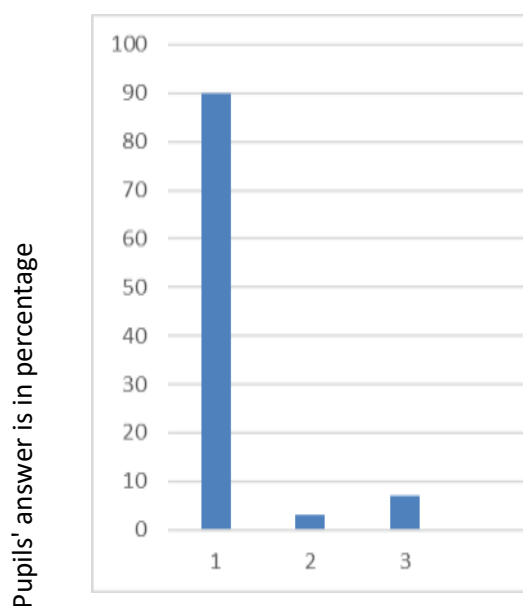
1. *Teacher's explanation*
2. *Independent work with the help of literature*
3. *With the help of friends and classmates*
4. *Using EP*
5. *Tutoring service.*

We attribute this to the lack of computers available to students. Personal interviews showed that almost every second person has a personal computer, some students have access to the Internet and use this network for communication. We must admit that students' low use of computer software products in solving chemical problems is due to their complete absence or very low educational effect in their use. At the same time, the obtained data show that students use all kinds of traditional methods that are not effective enough in learning to solve chemical problems. The current situation is aggravated by the lack of study time allocated to the study of the chemistry course, the poor health of students, frequent absences from classes and the heavy workload of teachers. As a result, most students' approach to learning to solve chemical problems is formal. Problems are not interesting for students who do not know chemistry well. Teachers try to get their attention in different ways. Changes related to the introduction of new educational standards make the situation even worse.

In this article, the use of information technology in teaching solving problems related to the main classes of compounds of inorganic substances: "Chemistry: for schoolchildren (using an interactive method to teach solving problems related to the main classes of compounds of inorganic substances using the method of proportions) self-study" using the electronic publisher (EP) to solve chemistry problems the results of using one of the possible teaching methods are offered.

On the basis of schools №17 and №23 of the Republic of Karakalpakstan, the subject of chemistry pedagogical experience of using the electronic publication (EP) "Chemistry: self-study for schoolchildren (using an interactive method in teaching solving problems related to the main classes of compounds of inorganic substances using the method of proportions) was conducted. Students of several classes of schools studied issues related to "main classes of inorganic compounds - oxides, acids, bases and salts" from the subject "Inorganic chemistry" according to the model program for general education schools. To teach problem solving through experience in the learning process, both in the classroom and in independent work outside the classroom Use of information technology in teaching solving

problems related to the main classes of compounds of inorganic substances: "Chemistry: for schoolchildren (use of interactive method in teaching solving problems related to the main classes of compounds of inorganic substances using the proportion method) self-study Possibilities of using the "teaching" electronic publisher (EP) while doing homework and preparing for exams have been identified. During the experiment, we wanted to confirm the initial hypothesis that the use of programmed learning in solving problems in chemistry facilitates the mastering of the studied material, helps to master the studied material. Developing students' problem-solving skills and strengthening the skills of solving various typical problems, forming chemical thinking in students and, as a result, activating their mental activity and increasing the power and quality of knowledge acquisition. Electronic publication(EP)was originally used to train individual users to solve problems. At this stage, it was important to determine the attitude of teachers to work. Their wishes and suggestions were collected and analyzed, recommendations were implemented in the structure of self-learning. In this way, adaptation of the self-study manual to different users was achieved, its improvement was carried out, functionality was determined, a "student-computer" interaction system was developed, and methodical approaches to application were formed. At the same time, the analysis of educational-methodological and scientific literature on the research topic was continued, assumptions were made and some laws were determined. In this case, even if there is only one computer in the classroom, electronic publication(EP)can be used during the explanation in a regular lesson. The self-study guide was useful for working in parallel in small groups. It was easy for the reader to show the way to solve the problem in the development of the electronic publication(EP). Many, in such questionnaires, one can see only positive opinions about electronic publication(EP) This observation suggests that a self-study guide, when used to teach typical problem solving in the classroom, has a greater effect on "weak" students and less on "strong" readiness. caused.



Picture 3. *Information technologies for students of chemical problems, "Chemistry: for schoolchildren (use of an interactive method in teaching solving problems related to the main class compounds of inorganic substances using the method of proportions) self-education" electronic publication Approach to learning to solve using (EP) . 1. I liked the work - 90%. 2. I did not like to work - 3% 3. The idea did not work - 7%.*

This assumption was later confirmed experimentally. We explain this fact by the fact that when working with a self-study manual, a certain way of thinking is formed in students, and mental actions are ordered, which is not enough for a "weak" student . This assumption was later confirmed experimentally.

4. Conclusion

1. The use of information technologies increases the effectiveness of education, eases the teacher's work, at the same time creates opportunities for creativity, changed the nature of the activities of students and teachers, and cooperation became the basis of their mutual relations .

2. In teaching students "Chemistry: for schoolchildren (use of interactive method in teaching to solve problems related to basic class compounds of inorganic substances using the method of proportions) self-study" electronic publication(EP)use has been tested. Its use in the educational process increases their interest in studying chemistry and improves their general emotional state.

3. "Chemistry: for schoolchildren (use of interactive method in teaching to solve problems related to the main classes of compounds of inorganic substances using the method of proportions) self-study" on the example of the electronic publisher (EP) The methodology developed for the use of information technologies of teaching does not conflict with the traditional teaching methodology, it is well combined with it. Practical recommendations for the use of EP in teaching chemical problem solving help to integrate it into the educational process.

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