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# Use of Mobile Software Applications in Developing Basic Competencies of Chemistry Students

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***Abstract***

*In this article, the issues of creation of national software applications, prototype design, placement of sections and placement of additional elements by specialists working in the field of chemistry teaching methodology and programming were considered. When creating software applications on science, it is necessary to take into account the characteristics of the subject when placing the components of the department, the content of educational materials, the harmony of colors, and additional elements. In addition, this article shows the importance of modular training in the formation of professional competence of chemistry teachers, i.e. personal professional qualities. The development of modern science and technology imposes a new approach to the teaching of chemistry in secondary schools, high demands on the content and level of knowledge and skills that students should acquire in this subject. To date, the volume of educational information has increased excessively, requiring not only to give knowledge to students, but also to "teach them to read and learn". Working and living in a rapidly changing and developing information society requires students not only to acquire ready-made knowledge, but also to independently search and process various types of information and use them effectively in various life situations. Nowadays, it is known that it is not enough for students to have only knowledge, skills and qualifications in educational subjects. Accordingly, there is a need to create and apply state education standards based on the competence approach to the educational process, which teaches students to apply the acquired knowledge, skills and abilities directly in their daily life. The word "competence" is derived from the word "to compete" and means «musobaqalashmoq», «raqobatlashmoq», «bellashmoq». In the scientific pedagogical, psychological, didactic literature, it can be seen that competence is a very complex, multi-part, coherent concept for many disciplines. Therefore, its interpretations are different both in size and content, as well as in terms of meaning and logical content. The essence of the term, as well as concepts such as "efficiency", "adaptability", "achievement", "success", "comprehensibility", "effectiveness", "readability", "property", "quality", "quantity" cannot be described on the basis of Education based on a competency-based approach does not require students to develop knowledge, skills and abilities separately, but to acquire them comprehensively. Accordingly, teaching methods will also change.*



**Keywords:** *Chemistry, Competence, Mobile Software Application, Competence Approach, Design Technology, Prototype*

## 1. Introduction

From the point of view of the competence approach, the essence of the educational process is the development of students' abilities (skills) to independently solve problems that they will face in

various life situations and fields of activity in the future, based on their own experience. This, in turn, provides students not only with knowledge, skills and abilities, but also with the formation of abilities (competencies) to use them in their daily needs. From this point of view, introduction of competence approach is one of the urgent problems facing the general secondary education system today. The main goal of the competence approach is to help the school graduate adapt to social life.

**Literature review**

The qualification requirements of general secondary education consist of requirements for the mandatory minimum and final goals of the content of education in general education subjects, the volume of training loads and the quality of education, and it consists of the following: knowledge - remembering and re-explaining the learned information; skill - being able to apply the learned knowledge in familiar situations; experience - the ability to apply the learned knowledge and developed skills in unfamiliar situations and create new knowledge; competence - the ability to use existing knowledge, skills and abilities in daily activities. Also, based on the content of each subject of general education, students' general competences related to the subject are formed. Education based on a competency-based approach does not require students to develop knowledge, skills and abilities separately, but to acquire them comprehensively. For this, it is necessary to clarify the concepts of competence and competence and determine its structure and function. Then, by creating the design technology of basic and subject competencies, the principles of choosing teaching methods are derived from it.

State educational standards (SES) and curriculum projects aimed at forming competencies in students of continuous education in general education subjects are implemented in practice and scientific research is carried out to eliminate shortcomings and problems in the achieved results - the expediency of conducting experimental-research works in methodical councils has been determined. Based on the continuity and integrity of education in the Republic of Uzbekistan, the priority of the student's personality and interests, it is envisaged to form the following basic competencies in accordance with their age characteristics. It is assumed that they have the competences of communicative, working with information, self-development, socially active citizenship, national and general cultural, mathematical literacy, awareness and use of science and technology news.


**Picture 1:** View of the Khimiya 4.0 mobile software application

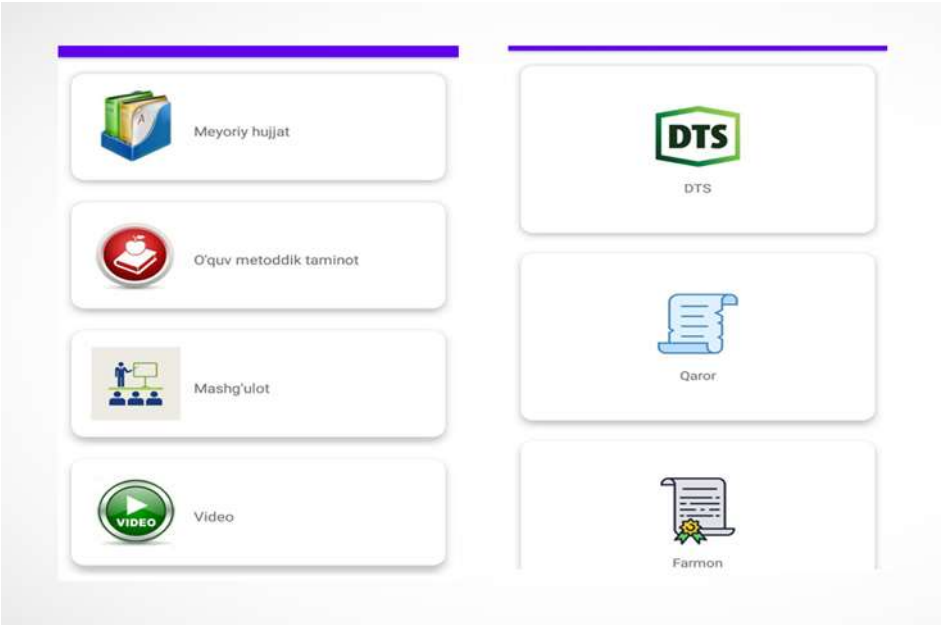
**Analysis**

In the process of developing innovative electronic didactic forms of education, the abilities and interests of learners are taken into account. In education, education is carried out on the basis of didactic and personal methodological procedures aimed at the implementation of its content, the design of the system in accordance with the educational goal, and the implementation of pedagogical-

psychological, digital technological methods, forms, and teaching methods; is a system of interaction between the giver and the learner. Today, mobile software applications designed for the use of many subjects have been created, and they are used to a certain extent in the educational process. The creation of mobile software applications from subjects is being created as a result of mutual cooperation of experts in the field of information and communication. Although there are a number of issues that need to be solved in this direction in our republic, developed countries have mobile software applications created in this field. These mobile apps allow you to find chemical reactions and solve chemical reactions involving one or more unknowns. It can also be seen that Mendeleev's periodic table and solubility tables have been placed (Pic. 1).

The process of creating a mobile application can be done in several steps. The purpose of the application being created by a science teacher or specialist is determined. After that, the mobile program starts creating the application. Initially, it is convenient to start work based on a specific idea. The science teacher's mobile software application is made up of sections, and reviews of what educational materials and other resources are placed in them are summarized. After the idea is consulted with the developer and feedback on the work is summarized, a prototype of the mobile software application is created based on the idea. The created prototype design, in which the arrangement of sections and placement of additional elements can be carried out. Color harmony and design should be carried out in consultation with designers based on the characteristics of science. Developers can usually do prototyping using special prototyping software: Marvel, InVision, Proto.io, Pixate, Framer, etc.

Currently, research is being conducted on the creation of national software applications by experts working in the field of chemistry teaching methodology and programming, there is a need today to create software applications for teaching chemistry at various levels of continuous education. Conducting research in this field, providing the opportunity to quickly introduce students to the news in science, it is convenient to demonstrate problems in the laboratory, and it serves to organize lessons in an interesting way. Based on the above-mentioned types, levels of competence, and the components that make up them, the work on the creation of a mobile software application was systematized by summarizing the researches intended to be used in the educational process of chemistry. In accordance with the school's 9th-grade chemistry program and plan, work was carried out, focusing on what sections the mobile application is made of, taking into account the convenience of students and teachers.




**Picture 2:** View of the "Chemistry" mobile application program

First, let's start the work by drawing the organizational structure of the 9th grade chemistry mobile program. The organizational structure shows the components of the mobile software application. The mobile application that we offer is planned to be composed of the following parts: educational and regulatory documents, theoretical exercises, practical exercises, laboratory exercises, video films, interesting information about science, various games about science, test questions to assess knowledge, can be composed of output sections. Today, life cannot be imagined without metals, dozens of metals and alloys cover all sectors of the national economy. Heavy-duty and light vehicles, agricultural vehicles, diesel locomotives, steam locomotives, airplanes, needles, nails, pens, etc., are all made of metals or mainly made of metals. Metals such as iron, copper, zinc, nickel, cobalt, aluminum, magnesium, tungsten, molybdenum, tantalum, titanium, niobium and alloys such as steel, cast iron, babbitt, duralumin, nichrome are of great practical importance.

How to get. Metallurgy deals with separating metals from their compounds. The main tasks of metallurgy are to return metals from their compounds and to separate metals from other substances. Various methods are used to extract metals from compounds. All methods of obtaining metals in industry are based on oxidation-reduction reactions, and currently the following methods are used:

• Pyrometallurgical methods.

• Hydrometallurgical methods.

• Electrometallurgical methods.

Methods of obtaining metals using these methods, areas of their use, rare and rare metals, and deposits of precious and other elements in our Republic are given.


**Picture 3:** Distribution, extraction and use of metals in nature" infographic

The mastery of educational materials related to the content of the subject is determined using the infographic in Picture 3. The use of such methods in the lessons serves to increase the level of learning and mastery of the subject, and to increase the students' interest in chemistry. Below is a brief description of the methodology of using "Problematic educational technologies" in teaching the topic "General properties of metals". Problem questions can be prepared for each of its sections. The questions chosen should create a problematic situation. The solutions to the teaching problems are solved together with the students. To teach the subject, the following problematic questions are referred to the students:

1. Explain why metals are soft or hard.

2. What are the properties of metals that do not crumble under the impact of hammering, and are malleable?

3. What is the reason why some metals are not resistant to corrosion?

4. Why does lithium take the first place in the series of activity, despite the fact that its activity is lower than that of sodium and potassium?

Students have different opinions on solving the first problem question. One student explains whether metals are soft or hard by their crystal structure, while another explains the electronic structure of metal atoms, and much debate ensues. During the lesson, the teacher summarizes the students' thoughts and opinions and gives solutions to the problems. It helps to solve the problem by stating the specific nature of the metal bond.

The nature of the metallic bond is that the bonding electrons of the atom in the metal move freely in the crystal lattice, as a result of which the valence electron of the metal atom is displaced from the atom, it becomes positively charged. Bonding of positively charged metal ions through negatively charged electrons is called metallic bonding. The main solution to the problems is that the number of valence electrons of the metal atom participating in the bond determines the main physical property of metal. For example, sodium metal is soft because one electron from each atom participates in the formation of bonds between sodium atoms. It is cut with a knife.

In calcium metal, two electrons from each atom participate in the metal bond. As a result, calcium becomes hard due to the increased dependence of the garden. Titanium is very hard, chromium is the hardest metal, because titanium has 4 electrons from each atom, and chromium has 6 electrons. The solution of each such problematic questions is solved with the active participation of students. Therefore, the effectiveness of the lesson will be high if the problem-based method is used to explain the knowledge of the subject, and the lesson is conducted in the style of interaction.

We will get acquainted with the possibilities of using problem-based educational technology in the course of "Copper and its compounds". The following problematic questions on this topic can be used during the training.

1. Explain the production processes of copper in Almalik.

2. What are the specific characteristics of the chemical properties of copper?

3. Explain the electronic structure of copper ammonia complex.

4. Tell the biological importance of copper in the human body.

As an example, we give the solution of the 3rd problematic question. When solving the question, students express different ideas. If the first student answers that $Cu^{+2}$ iom acts as a central ion in the formation of copper ammonia complex; Student 2 says that the ammonia molecule acts as a ligand. Student 3 states that the color of the solution changes when a complex compound is formed.

Solving issues related to the topic during the session. It serves to develop problem-solving methods, mathematical literacy, and science-related competencies. Based on the observations, it was concluded that today chemistry students face various difficulties in solving problems.

These problems can be observed from the results of entrance exams to higher education institutions. Therefore, it will be possible to solve the above-mentioned problems with the help of innovative educational technologies. This process requires the teacher to work on himself, master modern technologies, and acquire competencies in the use of digital technologies.

## 4. Conclusion

In explaining a new topic, the teacher can use the necessary information on the current topic from the Internet in addition to using existing textbooks and basic literature. Also, the mobile application has the ability to show movies related to the topic from the video section, and to show virtual experiences. The use of a mobile application in chemistry lessons helps to make the lesson interesting, to increase students' mastery of science-related educational materials, and to increase their interest in science.

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