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The Use of Digital Learning Platforms as a New Opportunity for Chemistry Education

Abstract

The article discusses the digital technologies used in the teaching of chemistry and the opportunities they create in the learning process. It highlights the indispensable role of digital tools in helping students more clearly understand chemical concepts and laws. The exceptional advantages and functions of artificial intelligence in the educational process are emphasized.

The current importance of distance education and the positive, effective changes it has brought into our lives are noted. The benefits of using online platforms—online lessons, virtual laboratories, mobile applications, and simulation models—in chemistry education are outlined.

The use of digital technologies, particularly in the teaching of chemistry, contributes to increasing students' cognitive activity, strengthening their motivation toward the subject, ensuring faster and more engaging comprehension of topics, and creating an interactive learning environment.

Research confirms that the use of digital technologies is one of the most essential factors in improving the quality of education. Thus, the field of digital technology is not only an expansive area of future development but also one of the primary priorities in integrating technological innovations into the education system.

Keywords: *digital technology, development, online platform, distance education, artificial intelligence, mobile application*

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Rəqəmsal tədris platformalarından istifadə kimya təhsilinin yeni imkanları vasitəsi kimi

Xülasə

Məqalədə kimya fənninin tədrisi prosesində istifadə olunan rəqəmsal texnologiyalardan və onların bu fənnin tədrisində yaratdığı imkanlardan bəhs olunur. Rəqəmsal texnologiyalardan istifadə etməklə kimyəvi anlayışların və qanunların şagirdlər tərəfindən daha anlaşılan formada mənimsənilməsində əvəzsiz rolundan danışılır. Süni intellektin təhsil prosesindəki müstəsna üstünlükləri və rolu vurğulanmışdır. Distant təhsilin hazırkı əhəmiyyəti və həyatımızda yaratdığı müsbət, effektiv dəyişikliklərlə irəliləməsi qeyd olunmuşdur. Onlayn platformalar — onlayn dərslər, onlayn laboratoriyalar, mobil tətbiqlər, simulyasiya modellərinin kimya fənninin tədrisində istifadə olunmasının üstünlükləri göstərilmişdir. Tədris prosesində, xüsusən də kimya fənninin tədrisində rəqəmsal texnologiyalardan istifadə şagirdlərin idrak fəallığının artmasına, onlarda mövzuya dair motivasiyanın yüksəlməsinə, mövzunun daha maraqlı və tez mənimsənilməsinə, eləcə də interaktiv mühitin yaranmasına xidmət edir. Aparılan araşdırmalar təsdiq edir ki, rəqəmsal texnologiyalardan istifadə təhsil prosesinin keyfiyyətini yüksəltmək üçün ən vacib amillərdən biridir. Deməli, rəqəmsal texnologiya sahəsi gələcəyin olduqca açıq sahəsi olmaqla yanaşı, həm də rəqəmsal texnologiyaların təhsil sahəsinə inteqrasiyası əsas prioritet istiqamətlərindən biridir.

Açar sözlər: *rəqəmsal texnologiya, inkişaf, onlayn platforma, distant təhsil, süni intellekt, mobil tətbiq*

Introduction

In today's globalized world, the changes occurring in the education system - particularly the rapid development of the field of chemistry - are closely linked to the quality of lessons delivered in general secondary schools. One of the primary issues currently facing education is the need to improve the quality of the learning process. Solving this problem directly depends on fostering students' cognitive activity. To enhance cognitive engagement, it is essential to spark students' interest in the learning process and activate as well as develop their agnostic functions. Various modern teaching methods and developmental instructional technologies are used to improve the quality of chemistry instruction. Selecting appropriate methods for specific situations is one of the main responsibilities of educators and methodologists in ensuring proper development. These instructional methods do not aim for the mechanical memorization of fact-based knowledge: rather, they ensure that students retain information by independently exploring, understanding, and applying it as researchers. Such methods help develop both educational and motivational characteristics in students (Guliyev, 2020, pp. 66–72).

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In particular, the role of digital technologies in education is now undeniable. One of the advantages of using digital tools in teaching is their ability to enhance learning quality. Game-based learning can increase cognitive engagement and simulate students' interest in lessons. A study conducted by Lenhart and colleagues in 2008 confirmed that 97% of children aged 12-17 play games using technological devices such as computers and phones. Game-based learning, which enhances students' cognitive activity through gameplay and provides them with stimuli based on their problem - solving abilities, is referred to as the game-based learning model. In game-based learning, a balance must be maintained between the instructional material and entertainment: the tasks presented in the games should be appropriate to students' levels, and while playing these games, students should both remain engaged and learn the instructional content. In the teaching of chemistry, examples of technological tools used within the framework of game-based learning include platforms such as Professor Why, Hololab Champions, Edpuzzle, Wordwall and Kahoot.

Professor Why is a game in which students conduct experiments in an interactive format using an online laborty application.

Hololab Champions is a platform where students perform chemical experiments through artificial intelligence.

Edpuzzle is an online platform that allows teachers to access a wide variety of quality videos and create their own videos for use in the instructional process. Wordwall is an online platform that enables the development of numerous games in different formats related to chemistry.

Kahoot is a platform where multiple-choice questions, surveys, and comparative questions prepared by teachers or other users can be answered by participants through a game PIN using technological devices such as phones or tablets. Correct answers appear on the screen after a certain period of time. This platform fosters a sense of competition among students. It also allows the inclusion of image-based and video-based questions (Çolak Yazıcı, 2023).

When discussing digital technologies, it is essential to specifically address artificial intelligence, which has already become an integral part of our lives. Artificial intelligence is a collection of computer systems and algorithms that replicate the human brain, assist in learning, make decisions on behalf of humans, and possess problem-solving capabilities. Artificial intelligence can perform numerous functions: it understands human language, listens to questions posed by users, and analyzes many websites to offer individuals the answers they need. When a person wants to begin a task but does not know where to start, artificial intelligence proposes various ideas, helping to create a structured plan and form a clear understanding of the work to be done. When any image or video is uploaded, it analyzes the content and extracts relevant information. Just as in all other fields, artificial intelligence has particular significance in education. By using artificial intelligence, teachers can accurately analyze students' knowledge levels, identify their strengths and weaknesses, and assess their abilities. At the same time, teachers enhance their own scientific skills and competencies through AI, while students use it to process learning materials at a high level and to present them in a highly engaging manner. Naturally, each students' learning level and cognitive activity differ from another. Artificial intelligence takes into account each students' individual learning abilities and prepares instructional materials tailored to their cognitive level. This ensures effective development (Mammadova, 2025, pp. 180–183).

We have noted that artificial intelligence is used in education. But what are its advantages and disadvantages? This is a particularly important question. Artificial intelligence can be used for administrative tasks, supporting the establishment of effective teacher-student relationships, preparing individualized plans based on students' knowledge, skills, and competencies, and improving educational opportunities for inclusive education and students with disabilities. Its advantages go even further. AI helps teachers and researches obtain new information to enhance curriculum development and increase its effectiveness. It also provides both teachers and students with unlimited resources, interactive platforms, and more. However, despite these advantages, artificial intelligence also has drawbacks.AI tools should be used to support development, yet in some cases, excessive use of such technologies can lead to laziness. Students or learners who rely too heavily on these tools may gradually lose their natural thinking skills. They tend to turn to these technologies for every problem they encounter, which is an undesirable situation. Additionally, issues such as ensuring privacy and security in the use of these technologies remain concerns for users. Their implementation also requires a certain amount of financial resources. Considering all these advantages and disadvantages, a proper balance must be maintained to ensure the correct use of artificial intelligence (Mammadova, 2025, pp.184–186).

If students and learners use artificial intelligence excessively, it may lead to a weakening of their communication skills and a disconnection from the real world. In the education system, students and university learners interact daily with many people - friends, teachers, professors, and others. This not only develops their social skills but also enhances their communicative abilities. As a result, they learn to express themselves correctly in any field or environment within society. All these abilities are formed through the communication they experience in educational institutions. For students who place artificial intelligence at the center of their lives, the development of such skills becomes extremely difficult (Taghieva, 2025, pp. 189–192).

The use of artificial intelligence also plays an important role in the field of chemistry.AI platforms help students understand chemical laws and perform laboratory experiments. Through molecular models, chemical reaction simulations, and virtual laboratory simulations, students gain deeper insight into complex chemistry topics that are otherwise difficult to comprehend. Let us examine some chemical artificial intelligence platforms:

Chemistry Quiz - This platform provides numerous chemistry-related questions, allowing students to complete many tests appropriate to their level. After completing the tests, students can view the correct answers and explanations.

Chemistry MCQ - This platform contains a large collection of multiple-choice choice questions covering various chemistry topics. It allows students to answer exam-style test items to review the subjects they have learned.

ChemCollective - This platform helps students learn chemistry topics interactively. It is especially useful in enabling students to conduct laboratory experiments online. It also demonstrates experiments that cannot be carried out in a physical laboratory, along with their results, helping students form a clear understanding of these experiments (Teknolojik Öğretmenler, 2024).

In addition to globally used educational platforms, there are also systems that are predominantly utilized within specific regions. One such example is inversity.org Originally developed in Germany, this platform maintains strong connections with several European countries. It contains a wide range of scientific resources and instructional materials covering various levels of education. Moreover, it offers numerous online courses designed for users seeking to advance their professional skills. The Openlearning educational platform was created in Australia. Compared to other platforms, its training services are somewhat limited. However, Openlearning emphasizes not only knowledge acquisition but also the development of a crucial factor learner-centered personal growth. The platform also includes group spaces where topics can be discussed and debated (Shafiyeva, 2025, p. 5).

Digital technologies also play an undeniable role in the STEAM education model currently implemented in our education system. As is known, the letter “T” in STEAM represents “Technology” which is one of the core components of the model. The STEAM approach is widely applied in the teaching of natural sciences, including chemistry. It is used to bridge theoretical knowledge with practical application- one of the fundamental principles of chemistry education. When scientific concepts are reinforced through hands- on STEAM activities, it significantly contributes to the development of students’ technological and engineering competencies. Furthermore, this model supports the integration of different subjects, which is now a common feature of modern lessons, thereby fostering the growth of students’ knowledge, skills, and competencies (Ahlimanova, 2021, p. 47).

Digital technologies are now being used intensively at all stages of the teaching process. Since 2020, the scope of their use has increased sharply. The pandemic period clearly demonstrated the importance of digital technologies to everyone - teachers, students, and all educational workers. Today, children are exposed to technology from the moment they are born. For this reason, the ability to use digital technologies has become a necessity for the new generation. Consequently, schools and the entire education system must be structured to meet the needs of this new generation. The Covid-19 pandemic provided the most illustrative example of this. After the pandemic, radical changes were observed in the education system. The pandemic forced us to incorporate digital practices into all areas of daily life, including education.

When the pandemic began, the traditional education system was replaced with online learning during the quarantine period. Learners no longer attended classrooms: instead, they continued their education through computers, mobile phones, and tablets, thanks to digital technologies. This sudden and radical shift within the education system brought many challenges with it. Many teachers - especially elderly teachers who had little or no experience with digital technologies - faced serious difficulties at the beginning of the process. Having never encountered such a situation before and relying solely on traditional teaching throughout their careers, they had made no effort to improve themselves in modern pedagogical technologies. At the same time, this radical transformation placed

significant responsibility on students and their family members. For the online learning process to function effectively, the joint effort of teachers, students, and parents was essential.

Naturally, not every parent knew how to use digital technologies proficiently. Therefore, during the initial phase of online education, both teachers and parents encountered numerous difficulties, as they had never been involved in such a situation before. After some time, however, through continuous effort, both teachers and parents acquired enough digital skills to manege the process effectively. This experience served as a lesson for everyone and demonstrated the indispensable role of digital technologies in education. Moreover, during the pandemic, the lack of prior experience with digital management platforms in educational institution caused significant challenges for staff, parents, and students.

One of the major contributions of the pandemic to the education system was that even after the return to traditional teaching, teachers had gained awareness of the importance of digital technologies and began integrating them into their lessons on a regular basis. Teachers, students, and parents all improved their digital competencies, and this development continues day by day (Najafazade, 2021, pp. 330–331).

In our country, the concept of distance education became popular during the pandemic: however, it has been used in many countries around the world for a long time. This form of education was first implemented in 1911 at Quidlent University. Later, distance education began to be adopted in countries such as Canada and the United States. From the 1920s onwards, distance education also started to develop in Russia. The initial development of distance education was closely linked to the invention of radio and television. At that time, instructional materials were delivered to students via postal mail. The first instance of education through radio took place in 1922 at the University of Pennsylvania, where students listened to lesson materials using radio broadcasts. After the invention of the internet, a new phase in distance education began. Higher education institutions started using websites to provide catalogs and learning materials online. By the end of the last century, as ICT had become an essential part of our lives, it brought a new approach to distance education. According to the modern perspective, ICT skills are now integrated into distance learning, marking one of the higest satges of its development (Abbasova, 2022, pp. 4–5).

Having emphasized the importance of digital technologies in education, it is also necessary to make extensive use of mobile applications, which are an important type of digital technology, in the teaching of chemistry. Some mobile applications used in chemistry education include:

AR Atom Visualizer for ARCore - Allows the visualization of atomic models in a realistic format, helping students form a clear understanding of atomic structures.

Molecule 3D - Displays molecular structures in 3D, allowing complex models to be observed in an understandable way.

Periodic Table 2025 - A comprehensive application that provides information about the elements in Mendeleev's periodic table, including interesting and essential details such as properties, melting points, and boiling points, and boiling points. It is a must-use tool for chemistry students.

Beaker - Mix Chemicals - Enables the performance of various chemical experiments online.

Unreal Chemist - Chemistry Lab - Allows students to conduct experiments that are not feasible in a physical laboratory. It contains all elements, their properties, and related information.

Periodic Table - Game - A game-based application that teaches students the periodic table through different levels of gameplay.

There are many such mobile applications for chemistry. When students use these applications alongside instructional materials, they enhance not only the quality of education but also students' learning activity and creative thinking skills (Ayyıldız & Karabulut, 2022, pp. 1112–1136).

Research

The integration of digital technologies into the education system has now become a necessity. But are teachers able to fulfill this responsibility?

In some schools in our country, the conditions for implementing digital technologies do not exist. However, in other schools where such conditions are available, teachers still do not use these

technologies in their lessons. For teachers to be able to use these tools effectively, they must first receive training specifically designed for this purpose. Teachers who have not undergone such training often fail to understand the importance of digital technologies and their role in education. Nowadays, teachers must continuously work on self-improvement, enhance their skills, and meet the demands of the modern era (Kaya & Tarkin-Çelikkıran, 2020, pp. 879–916).

When teaching chemistry, hundreds of digital technologies can be employed, including artificial intelligence applications, online platforms, websites, distance learning technologies, mobile applications, and more. Depending on the topic being taught, determining which digital technology to use and which tool is most appropriate for a particular lesson is one of the primary responsibilities of modern teachers.

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