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THE IMPACT OF THE PTABLE APPLICATION ON HIGH SCHOOL STUDENTS' ACQUISITION OF CHEMICAL KNOWLEDGE

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Abstract:
This article examines the impact of digital educational technologies, particularly the interactive periodic table Ptable, on the process of learning chemistry by high school students. The aim of the study is to evaluate the effectiveness of using the interactive digital periodic table in teaching the periodic system of chemical elements. The research was conducted through a pedagogical experiment involving control and experimental groups of students. Digital educational resources and the Ptable platform were used during the learning process. The results of the study showed that the use of interactive digital tools increases students' motivation, improves their understanding of periodic trends and the properties of chemical elements, and enhances the effectiveness of knowledge acquisition. The findings also indicate that digital resources contribute to greater student engagement and the development of analytical thinking in chemistry learning.

Keywords: digital technologies, Ptable, chemistry education, periodic system of elements, interactive learning, student motivation.

INTRODUCTION

Today, education is increasingly moving into the digital environment. The use of modern educational technologies has become an important condition for improving the effectiveness of the learning process and the quality of students' knowledge acquisition. Mobile applications, online resources, and various computer programs are gradually becoming a natural part of education and open new opportunities for teaching different academic disciplines.

The role of digital technologies is especially noticeable in the teaching of chemistry. To successfully study this subject, students must not only memorize facts but also understand the patterns of the periodic system of chemical elements and the relationship between atomic structure and the properties of substances. However, many of these concepts remain quite abstract and difficult for school students to understand when only traditional teaching methods are used [1].

The use of interactive digital educational resources makes the study of chemistry more visual and accessible. Such tools help students better understand the relationships between chemical elements, their structure, and their properties, and also contribute to the formation of a more holistic understanding of the patterns of the periodic system.

The scientific novelty of this research lies in the experimental evaluation of the effectiveness of using the interactive digital platform Ptable in studying the periodic system of chemical elements in the school chemistry course.

Purpose and Objectives of the Study

The purpose of this study is to examine the effectiveness of using the interactive digital periodic table Ptable in teaching chemistry to high school students.

To achieve this goal, the following objectives were identified:

- to analyze the educational capabilities of the interactive platform Ptable and its application in chemistry teaching;
- to organize a pedagogical experiment using digital educational resources;
- to compare the level of chemical knowledge acquisition between the control and experimental groups;
- to evaluate the influence of digital technologies on students' learning motivation and their interest in studying chemistry.

Research Methodology

The following methods were used in the study: a pedagogical experiment, testing, student questionnaires, observation of students' learning activities, and comparative analysis of the obtained results.

Traditional methods of teaching chemistry, which are mainly based on lecture explanations and the use of printed periodic tables, do not always allow students to fully understand the properties of chemical elements and the relationships between them. Concepts such as atomic radius, electronegativity, ionization energy, and periodic trends often remain abstract and difficult for students to comprehend [2].

In this regard, the use of interactive digital resources such as Ptable makes the process of studying the periodic system more visual and understandable. The Ptable platform is a modern interactive online resource containing detailed information about each chemical element, including its atomic mass, electron configuration, physical and chemical properties, and main areas of application. Due to its convenient interface and data visualization capabilities, this platform is actively used in educational practice and helps students better understand atomic structure and the properties of chemical elements [3].

The research was conducted among students of grades 10–11 at Secondary School No. 245 in the Uchtepa district of Tashkent. Twenty-four students participated in the pedagogical experiment and were divided into a control group and an experimental group, with 12 students in each group.

The control group studied using traditional teaching methods, while the experimental group used the interactive periodic table Ptable and mobile applications to study the properties of chemical elements.

The duration of the experiment was three weeks. Before the experiment began, an initial test was conducted to determine the students' baseline level of knowledge on the topic "The Periodic System of Chemical Elements." This made it possible to ensure that the preparation level of students in the control and experimental groups was approximately the same.

The research topic was "The Periodic System of Elements and Patterns in the Change of Element Properties."

Each lesson consisted of four stages:

1. brief theoretical explanation;
2. practical work with the Ptable application;
3. analysis of the properties of chemical elements and their changes in the periodic system;
4. completion of test tasks and discussion of the obtained results.

When studying chemical elements using the Ptable application, students were able to examine detailed information about each element, including its position in the periodic system, electron configuration, atomic mass, and main physicochemical properties, as shown in Figure 1.

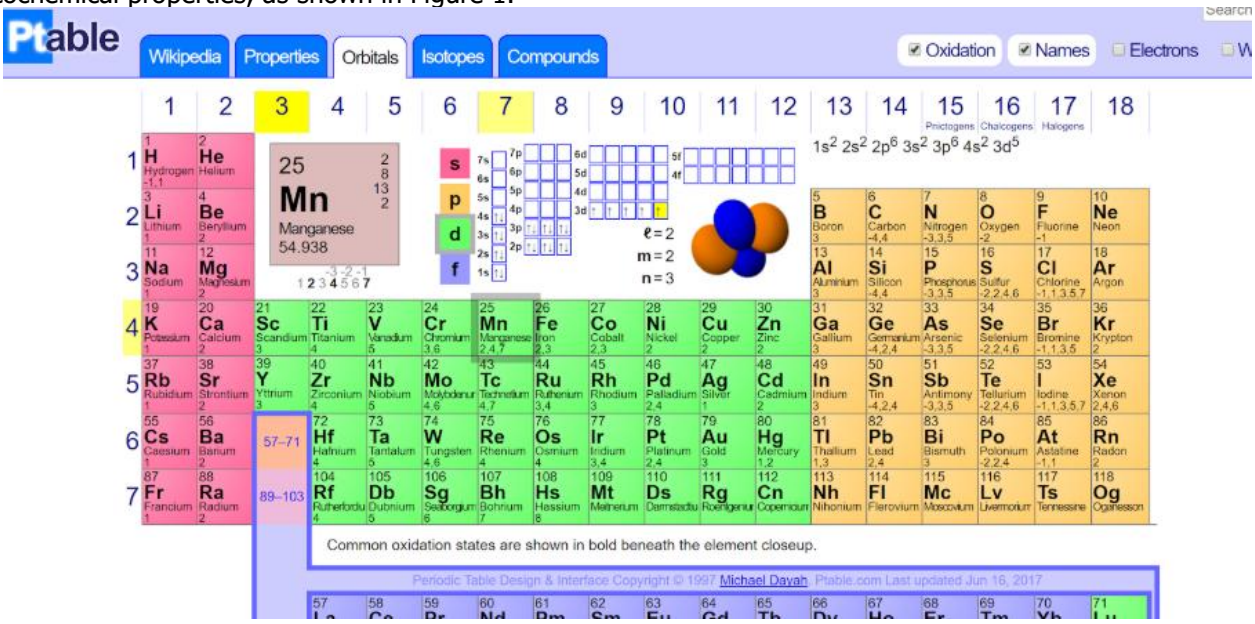

Figure 1. Graphical interface of the interactive periodic table Ptable.

The properties of chemical elements and their positions in the periodic system can also be seen in Figure 2.

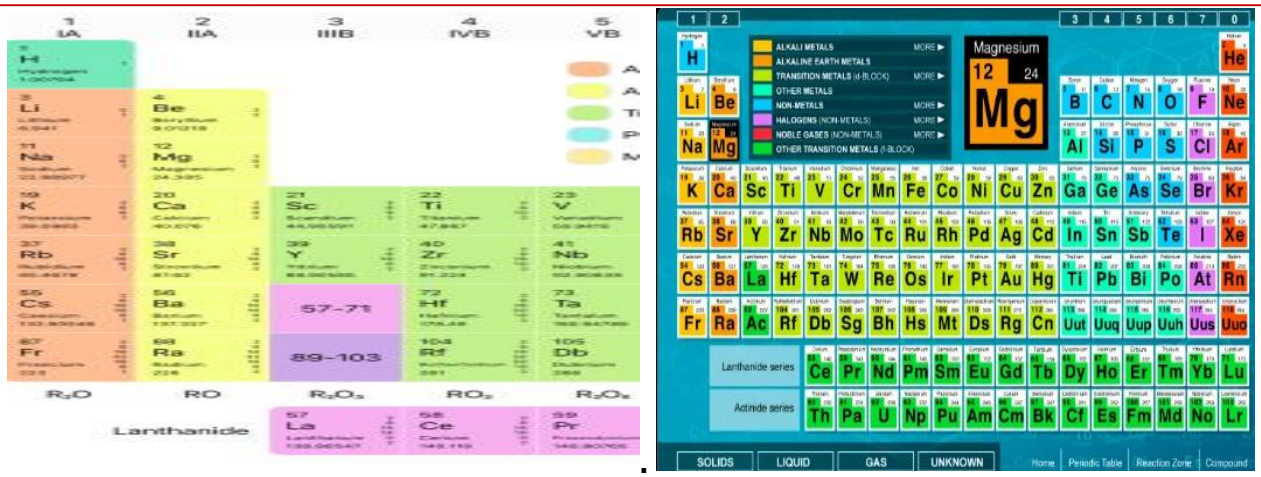

Figure 2. Comparison of periodic table visualization:
(a) a traditional static representation of the periodic table of chemical elements;
(b) the interactive digital periodic table in the Ptable application, displaying detailed information about elements, including atomic mass, electron configuration, and physicochemical properties.

Display of chemical element properties in the Ptable application:
(a) the position of an element in the periodic system;
(b) the main characteristics of the element, including atomic mass, electron configuration, and physicochemical properties.

Question for students:
Why do the properties of elements change across the periods and down the groups of the periodic system?
Note: Pay attention to the changes in atomic radius, electronegativity, and ionization energy when moving from one element to another.

RESULTS AND DISCUSSION

The results of students' knowledge acquisition when using the Ptable application are presented in Table 1.

Table 1

No	Indicator	Number of students (%)
1	Consider learning with an interactive periodic table interesting and visual	85%
2	Note that they better understand the properties of chemical elements	82%
3	Reported increased interest in studying chemistry	74%
4	Noted that the Ptable application is convenient and easy to use	78%
5	Expressed a desire to use Ptable in chemistry lessons	87%

The survey results presented in Table 1 are visually summarized in Figure 3, which illustrates students' perceptions of using the interactive periodic table Ptable in chemistry lessons.

Figure 3. Infographic representation of students' attitudes toward using the Ptable platform in chemistry learning.

The test results showed that students in the experimental group demonstrated higher academic performance: the average score was 79.3, while in the control group it was 65.1. The difference between the results of the experimental and control groups was 14.2 points, indicating a higher level of knowledge acquisition when interactive digital resources were used.

The obtained results indicate that the use of interactive digital tools contributes to a deeper understanding of the learning material. This can be explained by the fact that students are able to visually observe the properties of chemical elements and trace patterns in their changes within the periodic system.

The survey also showed that 90% of students consider learning with the Ptable platform to be more interesting and visually engaging; 83% noted that they better understand the properties of chemical elements; and 76% reported an increased interest in studying chemistry.

Teachers who participated in the experiment also noted the convenience of using the interactive periodic table and the ability to quickly find the necessary information about chemical elements. These results are consistent with the findings of international studies [4], which indicate that the use of digital educational resources increases students' cognitive activity and improves their understanding of scientific concepts.

In addition, the use of Ptable allows students to independently study the properties of chemical elements, analyze periodic trends, and compare different characteristics of elements. This approach contributes to the development of students' analytical thinking and the formation of research skills [5].

It should be noted that the conducted study has certain limitations related to the relatively small number of participants and the limited duration of observation. In the future, it would be advisable to conduct larger-scale studies involving a greater number of students in order to more comprehensively evaluate the effectiveness of digital educational technologies in chemistry teaching.

CONCLUSION

The conducted research showed that the introduction of digital educational technologies into the chemistry learning process contributes to increased student motivation, greater engagement in learning activities, and improved learning outcomes.

The use of the interactive periodic table Ptable contributes to:

- a deeper understanding of the patterns of the periodic system of chemical elements;
- the development of students' analytical and logical thinking;
- the formation of stable knowledge and the development of research skills.

Thus, the integration of digital tools such as Ptable can be considered one of the effective directions for modernizing chemistry teaching in upper secondary schools.

The practical significance of the research lies in the fact that the obtained results can be used by chemistry teachers when organizing the educational process in high school. The use of interactive digital resources, including the Ptable platform, makes learning more visual, understandable, and effective.

Future research prospects are related to expanding the use of interactive digital educational resources in chemistry teaching and developing new methodological approaches to the use of mobile applications and online platforms in school education.

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