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USING INFOGRAPHICS IN STUDYING COULOMB'S LAW BY STUDENTS OF THE "SOFTWARE ENGINEERING" PROGRAM: PEDAGOGICAL EXPERIENCE

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Abstract

The article presents the experience of using infographics as a form of students' independent work in the study of physics. As an example, the creation of infographics on the topic "Coulomb's Law" by students of the "Software Engineering" program is considered. The aim of the work was to increase students' interest in physics, as well as to develop their digital and visualization skills. It is shown that the development of infographics contributes to a deeper understanding of physical laws, the formation of interdisciplinary competencies, and an increase in learning motivation. The obtained infographics can be recommended for use in the school physics course.

Keywords

physics education, infographics, Coulomb's law, independent work, software engineering, digital technologies.

In modern conditions of engineering education, the role of interdisciplinary approaches combining fundamental knowledge and digital competencies is increasing. The greatest interest of future engineers in the studied material arises when the connection with their chosen specialty is obvious to them. Students often, based on limited professional experience or its absence, draw an unjustified conclusion about the "uselessness" of certain sections of physics. For students of the "Software Engineering" program, the study of physics is often perceived as abstract or weakly related to future professional activity. The perception of the presented material becomes much more effective if students are interested in the topic from the very beginning of the class.

In this regard, an urgent task of the teacher is to search for such forms of instruction that would increase students' interest in physics and demonstrate its practical significance. Therefore, teachers strive to diversify teaching methods.

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These may include solving non-standard problems (1–3), compiling reference cards and lesson outlines (4–6), constructing crosswords (7), preparing tests, logical games, etc. One of such forms is the use of infographics, which make it possible to visualize complex physical concepts and laws. The scientific literature emphasizes that knowledge visualization through infographics enhances perception, promotes information systematization, and stimulates independent thinking (8–15). Creating high-quality infographics is a creative task that requires significant effort and time. Therefore, the exchange of experience in developing infographic resources in physics is of great importance.

The purpose of this work is to analyze the pedagogical experience of using infographics in studying Coulomb's law within the framework of students' independent work.

Research objectives:

– to involve students in active independent activity;
– to deepen understanding of Coulomb's law and its physical meaning;
– to develop visualization skills and the use of digital tools;
– to increase students' learning motivation;
– to assess the educational effect of using infographics.

The study involved students of the "Software Engineering" program. As part of independent work, they were asked to create infographics on the topic "Coulomb's Law" based on lecture materials. Students worked mainly independently, choosing the structure of the infographic, graphic elements, and methods of presenting information. During the process, discussions were held in which students and the teacher exchanged opinions, analyzed mistakes, and made adjustments. The use of artificial intelligence elements was auxiliary in nature and did not replace students' independent analytical activity. The teacher developed the methodological framework of the work and carried out guidance and pedagogical analysis. As examples, several variants of infographics in Russian created by students on the topic "Coulomb's Law" are presented below (Figs. 1, 2, 3).

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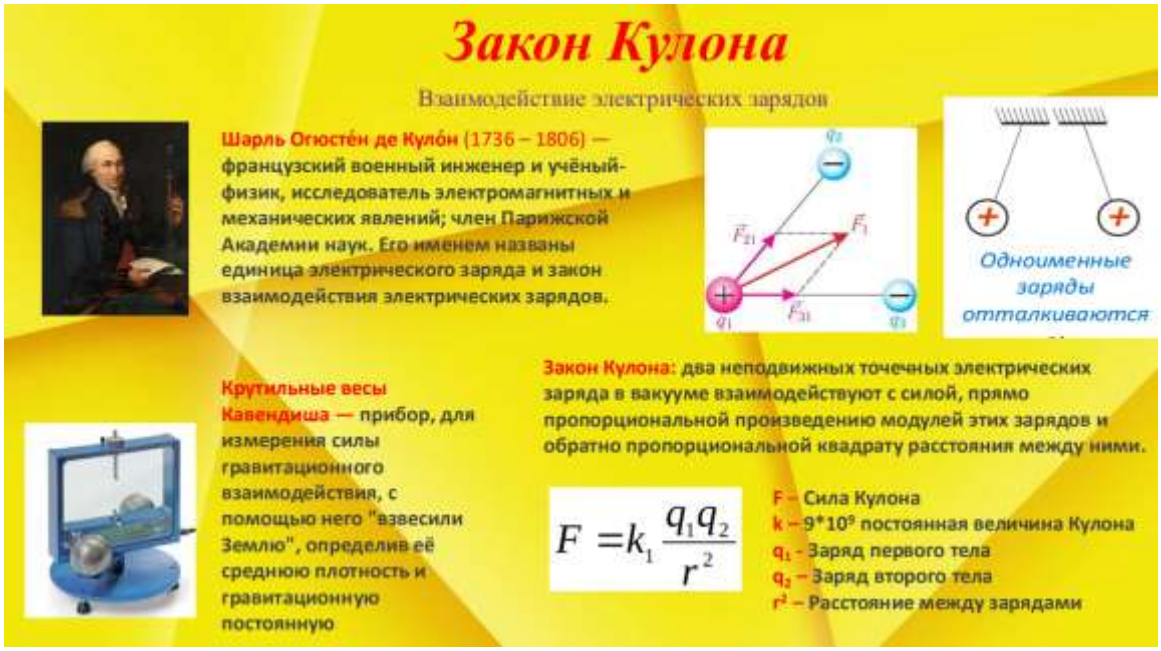

Fig 1.

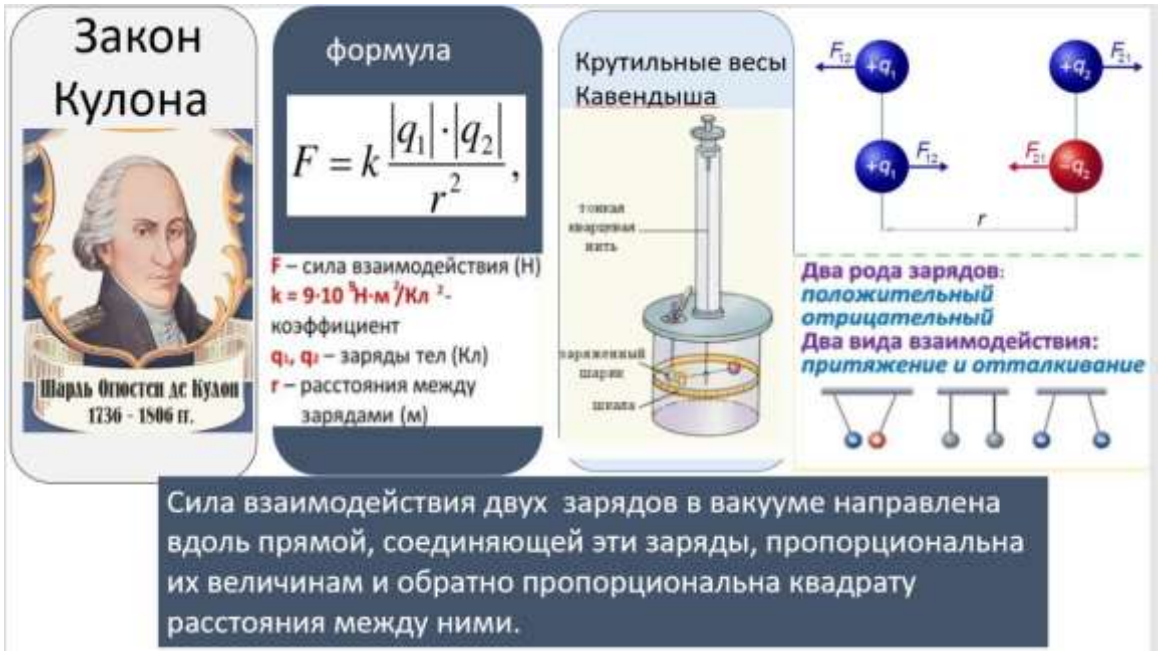

Fig 2.

Coulomb's law is one of the fundamental laws of electrostatics. Electrostatics studies the interaction and equilibrium conditions of stationary electrically charged bodies, as well as the properties of these bodies determined by electric charges.

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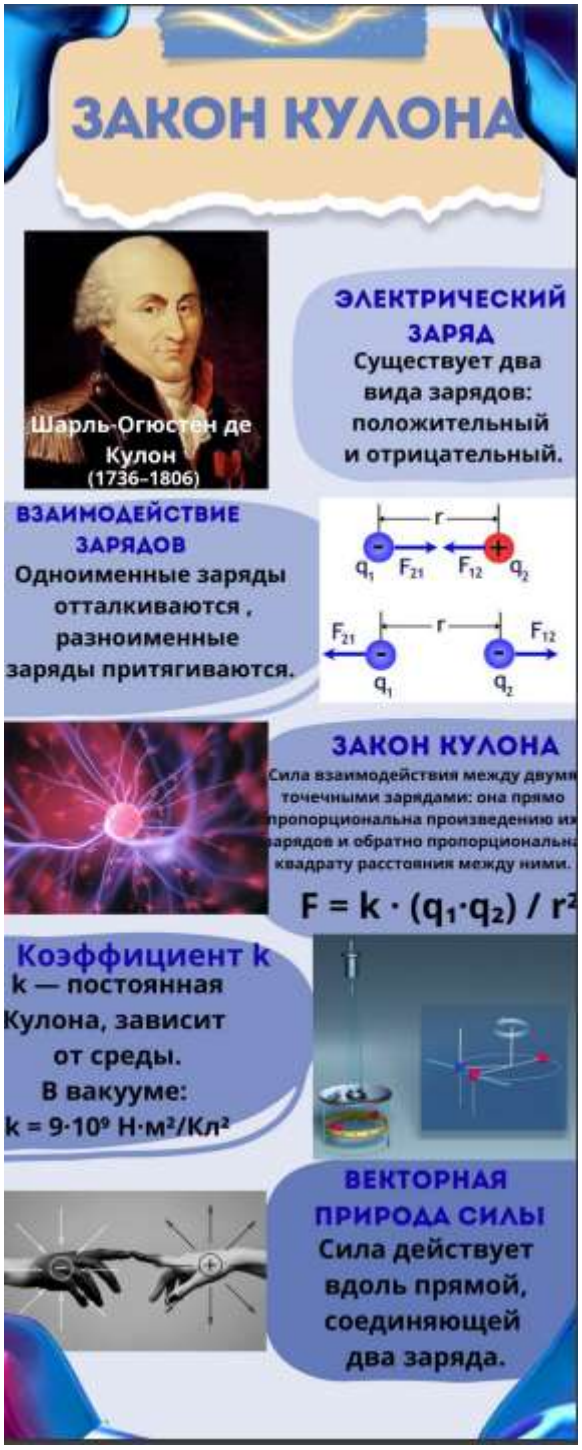

Fig 3.

There are two types of electric charges: positive and negative. The material carrier of the smallest negative charge is the electron. This smallest quantity of charge is called the elementary charge. Any electric charge is a multiple of the elementary charge. Electric charges interact with each other: like charges repel, and unlike charges attract. The first quantitative studies of the interaction of stationary electric charges were carried out in 1785 by the French physicist Charles-Augustin de Coulomb, who experimentally, using a torsion balance, established the dependence of the interaction force between two stationary point charges in a

vacuum on their magnitudes and the distance between them. Coulomb's law states that two charges in a vacuum interact with a force proportional to the product of the magnitudes of the charges and inversely proportional to the square of the distance between them, and directed along the line connecting the charges. In the case of charged spheres, the distance is measured between their centers.

The developed infographics reflect the following aspects of Coulomb's law:

– the mathematical formulation of the law;

– the physical meaning of electric charge interaction;

– the direction and vector nature of the force;

– the dependence of the interaction force on the distance between charges.

Despite the common topic, each infographic differs in individual style, structure, and visual logic, which indicates the creative approach of the students.

During the process of creating infographics, students demonstrated a deeper understanding of the studied material compared to traditional forms of independent work. Active discussions contributed to the development of critical thinking and the ability to justify one's own decisions. The creation of infographics allowed students to master new possibilities of computer technologies and to see the connection between physics and their future professional activity. The final academic performance of students was assessed as "good" and "excellent." Teaching reflection showed that this form of work was interesting and effective not only for students but also for the teacher.

Conclusion

The obtained experience confirms the expediency of using infographics in teaching physics to students of engineering specialties. The developed infographics can be recommended for use in the school physics course as additional visual material. The use of infographics in studying Coulomb's law contributes to increasing students' interest in physics, developing digital competencies, and forming interdisciplinary thinking. The presented experience can be applied and expanded when studying other topics of the physics course.

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