

DEVELOPING STUDENTS' IMAGINATION AND CRITICAL THINKING
SKILLS IN THE TOPIC OF "X-RAYS AND THEIR APPLICATIONS"**Nomozova Dilnoza**Shahrisabz State Pedagogical Institute
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Abstract: This article analyzes the properties of X-rays and their applications in enhancing students' scientific imagination and developing their critical thinking skills. Through practical and theoretical exercises, opportunities are created for students to explore discoveries and foster interest in scientific research.

Keywords: X-rays, pedagogical approaches, teaching methods, interactive methods, innovative education, artificial intelligence.

Introduction. X-rays are one of the significant discoveries that hold great importance in human life. X-rays were discovered in 1895 by the German physicist Wilhelm Rontgen. The radiation with wavelengths between ultraviolet and gamma rays is referred to as X-rays. X-rays are generated as a result of the collision of electrons with matter. They play a crucial role in modern science and technology. X-rays are a part of the electromagnetic spectrum and possess high energy. These rays are widely

used for obtaining internal images of the human body and for studying the properties of materials. They can penetrate matter and reveal dense tissues such as bones, which allows for their extensive use in medicine. The first X-ray image was taken in 1896, leading to revolutionary changes in medicine. Currently, X-rays are widely used in medicine, science, and industry, providing significant assistance to humanity. Interestingly, only X-rays can offer the ability to see images composed of bones. The physical properties and production of X-rays greatly aid in determining their level of penetration through various materials.

X-rays are used in various fields:

1. **Medicine:** In medicine, X-rays are used in diagnostic processes, such as examining bones, imaging internal organs, and in oncology.
2. **Industry:** They are utilized for inspecting materials and controlling quality.
3. **Biology:** These rays help in studying the structure of plants and animals.

Innovative methods of using X-rays are applied in the following areas: With digital X-rays, we can obtain images more quickly and accurately. 3D X-rays provide precise information about bones and organs, which can be used in diagnostics and surgical procedures. Artificial intelligence aids in the automatic analysis of X-ray images, accelerating the process of disease detection and medical decision-making. These innovative methods expand the use of X-rays and enhance their effectiveness.

Various teaching methods can be employed to explain this topic to students. For example, using video materials, animations, and presentations. To make the learning process engaging, educational games and quizzes should be incorporated into the teaching process. This approach increases students' interest and makes the learning process more effective.

To make the topic more understandable for students, the following methods can be used:

1. **Comprehensive Explanation:** Provide detailed information about how X-rays were discovered, their physical properties, and their applications.

2. Practical Examples: Present real-life examples to students, such as demonstrating how X-ray images are used in medicine.
3. Interesting Stories: Tell stories about the discovery of X-rays and the revolutionary changes that resulted from their use. This will increase students' interest in the topic.
4. Visual Aids: Use diagrams, graphs, and videos to present the topic more clearly. Visual materials make it easier for students to understand.

When teaching students the topic "X-rays and Their Applications," theoretical lessons (introductory lectures, interactive presentations), practical exercises (simulation programs, laboratory research), research projects, excursions in medical settings, interesting materials (books, articles, videos), games, and quizzes can be used to help students gain more knowledge on the subject.

During the teaching process, utilizing interactive learning platforms, virtual reality experiences, databases on X-rays, exhibitions, seminars, educational games, and other innovations will not only increase students' interest but also broaden their knowledge and imagination. Additionally, explaining the topic with the help of information technology will provide students with a wealth of information. The topic "X-rays and Their Applications" can also be explained to students using the Macro Media Flash program. This software allows for the creation of animations that demonstrate how X-rays work, as well as diagrams illustrating the propagation, wavelength, and energy of X-rays. Implementing all of this interactively in Flash will make it engaging and beneficial for students. Furthermore, we can use programs like PhET Interactive Simulations, Camtasia or OBS Studio, PowerPoint or Google Slides, Kahoot or Quizizz, Google Earth, or Google Maps during the teaching process.

Research Methodology. X-rays are electromagnetic rays that are widely used in various fields, including medicine, industry, and scientific research. X-rays play a crucial role in visualizing and analyzing the internal structures of the human body.

Purpose of the Research: To enhance students' knowledge about X-rays and develop

their critical thinking skills. This research will involve 30 students. During the lesson, the following methods can be utilized.

Surveys: Provide students with surveys before and after the lesson. The surveys may include the following questions:

- What are X-rays?
- Who discovered X-rays?
- In which fields are X-rays used?
- What do you know about the risks of X-rays?

Quick Test: Prepare a test consisting of 10 questions for the students.

Group Discussion: Divide students into small groups to discuss the benefits and risks of X-rays.

Practical Exercises: Organize an excursion to a medical institution to see X-ray machines and work with X-ray images.

Analysis and Results. We will compare the test results of the students before and after the research. We will analyze the opinions and approaches discussed in the group discussions.

If students initially answered an average of 80% correctly, it is expected that this percentage will increase to 85% after the research. In group discussions, students are expected to express their opinions freely and propose new ideas and solutions. Utilizing these methods will help students understand the topic well and significantly enhance their knowledge and imagination regarding it.

Conclusion. In the future, applying modern technologies, such as virtual reality and augmented reality, in the study of X-rays will enrich students' experiences further. These technologies will assist students in learning the topic practically and applying their knowledge to solve real-world problems. X-rays play a crucial role in the fields of science and technology, with their applications expanding in medicine, industry, and biology. Additionally, employing innovative methods in the educational process is vital for engaging students and reinforcing their knowledge. By using various methods,

visual aids, presentations, and information technologies during lessons, the class becomes very interesting, and the new topic becomes understandable for students.

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