

THE ROLE OF ARTIFICIAL INTELLIGENCE IN CONDUCTING LABORATORY CLASSES ON NUCLEAR TECHNOLOGY EQUIPMENT IN MEDICAL HIGHER EDUCATION INSTITUTIONS

Sayfullayev Ramziddin Fazliddin o'g'li

Assistant, Department of Mathematics and Information Technologies
 Oriental University

E-mail: ramziddincr7@gmail.com

Bozorov Erkin Xojiyevich

Chief Researcher, Laboratory of Nuclear Medicine
 Institute of Nuclear Physics

Professor, Department of Nuclear Physics, Faculty of Physics,
 National University of Uzbekistan

Doctor of Physical and Mathematical Sciences

E-mail: bozorovE@gmail.com

Xojiyeva Moxlaroyim Erkin qizi

Student of Tashkent Medical University
 Tashkent medical university

Nasirov Maxmud Ualiyevich

Independent researcher of the Ajiniyaz Nukus State Pedagogical Institute

Abstract: This scientific article analyzes the pedagogical, technological, and methodological aspects of using artificial intelligence (AI) technologies in organizing laboratory classes on nuclear technology equipment in medical higher education institutions. When working with complex equipment used in radiology, nuclear medicine, radiopharmacy, and nuclear diagnostics, issues of safety, accuracy, and resource efficiency are of critical importance.

The study examines the impact of AI-based virtual laboratories, digital simulators, adaptive learning systems, and intelligent assessment mechanisms on the effectiveness of laboratory training. The results demonstrate that artificial intelligence technologies serve as an effective tool for developing students' practical skills, reducing risk factors, and improving the overall quality of the educational process.

Keywords: artificial intelligence, nuclear technologies, nuclear medicine, laboratory classes, virtual laboratory, simulation, pedagogical technologies, medical education.

Literature Review

In recent years, the number of scientific studies on the implementation of digital technologies—particularly artificial intelligence-based learning systems—in medical education has increased significantly. International research extensively highlights the role of AI in medical image analysis, diagnostic decision support, and optimization of clinical workflows. However, the application of AI in laboratory classes related to nuclear technology equipment remains relatively underexplored.

Several studies consider virtual laboratories as an effective alternative to real nuclear installations, emphasizing their high level of safety and economic efficiency. Furthermore, research confirms that adaptive learning algorithms enable the development of laboratory tasks tailored to students' individual knowledge levels.

The literature review indicates that AI-based simulations facilitate students' understanding of complex physical and technological processes. Nevertheless, effective pedagogical integration of these technologies into the educational process is essential to achieve sustainable learning outcomes.

Research Methodology

A comprehensive methodological approach was applied in this study, including:

Theoretical analysis – examination of existing scientific literature on nuclear technologies and artificial intelligence;

Pedagogical experiment – comparison of AI-based virtual laboratory classes with traditional teaching methods;

Surveys and tests – assessment of students' knowledge levels and laboratory skills;

Statistical analysis – quantitative processing and interpretation of obtained results.

The research was conducted with the participation of students specializing in nuclear medicine and radiology at medical higher education institutions.

Analysis and Results

The results of the pedagogical experiment revealed that students who participated in AI-based laboratory classes demonstrated higher learning outcomes compared to those trained using traditional methods. In particular:

The level of understanding of complex nuclear processes increased;

The number of operational and conceptual errors decreased;

Independent problem-solving and practical skills improved.

Through virtual simulators, students were able to study hazardous situations related to radioactive sources without causing harm to real environments or equipment. This approach significantly enhanced safety awareness and confidence in handling nuclear technology equipment.

Pedagogical Analysis and Discussion

From a pedagogical perspective, artificial intelligence technologies enable laboratory classes to be organized in a learner-centered, adaptive, and interactive manner. Adaptive assessment systems help identify individual learning trajectories and provide personalized feedback.

In this context, the instructor's role shifts from that of a controller to a guide and facilitator, supporting students' independent learning and critical thinking. This pedagogical transformation contributes to deeper conceptual understanding and long-term skill development.

Conclusion and Recommendations

The research findings confirm that the use of artificial intelligence in organizing laboratory classes on nuclear technology equipment in medical higher education institutions significantly enhances educational quality.

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Recommendations:

Gradual integration of AI-based virtual laboratories into medical education curricula;

Organization of specialized professional development courses for instructors;

Development of digital modules addressing nuclear safety and ethical considerations.

References

1. Russell, S., & Norvig, P. *Artificial Intelligence: A Modern Approach*. Pearson Education.
2. International Atomic Energy Agency (IAEA). *Nuclear Medicine Physics: A Handbook for Teachers and Students*. Vienna.
3. Topol, E. *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again*. Basic Books.
4. OECD. *Artificial Intelligence in Education: Challenges and Opportunities*.
5. Xoliqov, A., & Karimov, B. *Digital Technologies in Medical Education*. Tashkent, 2022.
6. Islomov, D. *Fundamentals of Nuclear Medicine*. Tashkent, 2021.