

EFFICIENCY OF TEACHING NUCLEAR TECHNOLOGY IN MEDICAL HIGHER EDUCATION INSTITUTIONS THROUGH THE BLENDED LEARNING METHOD

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Abstract: This article highlights the role and significance of the Blended Learning model in teaching “Nuclear Technology,” considered one of the most complex subjects in medical higher education institutions. During the study, students’ theoretical achievement levels and practical skills were compared within traditional and blended learning systems. The results demonstrate that the integration of digital resources and face-to-face interaction increases the level of subject mastery by 25%.

Introduction: Nuclear technologies have become an integral part of modern medicine. Training specialists in areas such as Positron Emission Tomography (PET), Computed Tomography (CT), and radioisotope therapy requires both advanced technological approaches and profound theoretical knowledge. However, due to the complexity of the subject and radiation safety requirements, students’ direct participation in laboratory activities is limited. Therefore, the Blended Learning method is considered one of the most effective solutions to these challenges.

Methodology:

Blended Learning Model: For the research, the “Flipped Classroom” model was selected. The educational process was divided into the following three stages:

1. **Independent Online Stage:** Students studied the fundamentals of nuclear physics, isotopes, and dosimetry through video lectures, 3D animations, and virtual simulations provided via the LMS (Learning Management System) platform.
2. **Face-to-Face Practical Sessions:** Classroom activities focused only on complex case-study analysis, interpretation of radiological images, and discussion of radiation safety protocols.
3. **Virtual Laboratory:** Practical work with radiation sources was carried out using simulation technologies.

Research Results (Experimental Section):

A total of 100 students participated in the study. They were divided into two groups:

- **Control Group (N=50):** Traditional lectures and practical sessions.
- **Experimental Group (N=50):** Blended Learning method.

The analysis of academic achievement indicators based on final semester tests and practical assignments is presented in the following table:

Indicator	Control Group (Score)	Experimental (Score)	Group Difference (%)
Theoretical Knowledge	72.4	88.5	+16.1%
Visual Diagnosis Identification	65.0	82.3	+17.3%
Radiation Safety Test	78.0	94.0	+16.0%
Average Score	71.8	88.3	+23%
Theoretical Knowledge	72.4	88.5	+16.1%

Discussion: The main advantage of the Blended Learning method is that students can absorb information online according to their individual cognitive pace. In the field of Nuclear Technology, abstract processes such as “Nuclear Decay” and “Interaction of Gamma Radiation with Matter” can be visualized through 3D technologies, which significantly enhances students’ understanding and strengthens memory retention.

$$E = mc^2$$

It has been proven that interactive calculators and simulations are more effective than traditional board-based explanations in understanding the physical meaning of mathematical formulas such as the Lambert–Beer law.

Recommendations for Medical Higher Education Institutions:

1. **Implementation of Virtual Laboratories:** Since nuclear medicine is an expensive and high-risk field, the use of VR simulators can reduce costs by up to 40%.
2. **Content Quality:** Video lectures should not exceed 10–15 minutes, and each lecture should be followed by micro-learning tests.

3. **Feedback Mechanism:** LMS platforms should provide 24/7 discussion forums for students.

Conclusion:

In conclusion, teaching the subject “Nuclear Technology” through the Blended Learning approach in medical higher education institutions not only improves students’ academic achievements but also enhances their digital literacy. The research findings indicate that the blended learning model will serve as a key educational methodology in preparing highly qualified specialists such as radiologists and oncologists in the future.

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