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IMPROVING THE DEVELOPMENT OF PROFESSIONAL COMPETENCE OF FUTURE PHYSICS TEACHERS THROUGH THE COURSE «PHYSICS OF SEMICONDUCTORS AND DIELECTRICS»

1. Introduction

The rapid development of science and technology requires modern education systems to prepare highly qualified specialists. In particular, the training of future physics teachers demands not only deep subject knowledge but also well-developed professional competencies.

Professional competence includes pedagogical skills, subject knowledge, and the ability to effectively use modern educational technologies. According to John Hattie (2009), teaching effectiveness significantly depends on the teacher's ability to integrate different knowledge domains.

The course "Physics of Semiconductors and Dielectrics" plays an important role in shaping the scientific worldview of students. It provides fundamental knowledge about modern electronic materials, which are widely used in technology. Therefore, improving the methodology of teaching this course is essential for enhancing the professional competence of future teachers.

2. Literature Review

The concept of professional competence in teacher education has been widely studied. The TPACK framework proposed by Mishra and Koehler emphasizes the integration of technological, pedagogical, and content knowledge.

Richard E. Mayer (2009) highlights the importance of multimedia tools in enhancing students' cognitive processes. Similarly, UNESCO (2018) underlines the necessity of ICT competencies for modern teachers.

In the field of physics education, classical textbooks such as Introduction to Solid State Physics and Solid State Physics provide theoretical foundations for understanding semiconductors and dielectrics.

Recent studies show that integrating digital simulations and virtual laboratories

into physics teaching significantly improves conceptual understanding and student engagement.

3. Methodology

The research employed a mixed-method approach combining theoretical analysis and experimental study. The experiment was conducted with students of physics education programs.

The methodology included:

- implementation of digital learning tools (simulations, virtual labs)
- use of interactive teaching methods
- assessment through tests and practical assignments

Students were divided into control and experimental groups. The experimental group was taught using technology-enhanced methods, while the control group followed traditional instruction.

4. Results and Discussion

The results of the study demonstrated that students in the experimental group showed significantly higher academic performance and deeper conceptual understanding.

The integration of digital tools allowed students to:

- visualize complex physical processes
- understand abstract concepts more easily
- develop independent learning skills

Moreover, the use of simulations in teaching semiconductors helped students better understand charge carrier movement, band theory, and conductivity mechanisms.

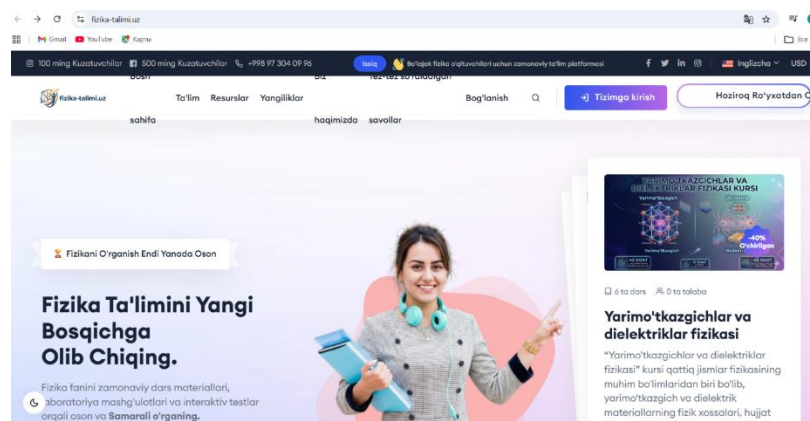


Fig. 1. Working Window of the Physics Education Platform

The findings support the idea that combining pedagogy, technology, and subject content enhances professional competence. This aligns with the conclusions

of Diana Laurillard (2012), who emphasized the importance of technology-supported learning design.

5. Conclusion

In conclusion, improving the teaching methodology of the course “Physics of Semiconductors and Dielectrics” plays a significant role in developing the professional competence of future physics teachers.

The study confirms that:

- digital technologies enhance learning effectiveness
- integrated teaching approaches improve competency development
- modern methods prepare teachers for real educational challenges

Therefore, it is recommended to widely implement digital tools and innovative pedagogical strategies in physics teacher education programs.

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