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TECHNOLOGIES FOR DEVELOPING METHODOLOGICAL TRAINING OF FUTURE INFORMATICS TEACHERS

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ABSTRACT: This article examines the technologies for developing methodological training of future informatics teachers. The study analyzes the current state of methodological preparation of informatics teacher candidates in higher educational institutions and identifies key challenges in the existing training system. The research proposes and evaluates a set of innovative pedagogical technologies including project-based learning, case-study methods, digital simulation environments, and competency-oriented instructional design. Particular attention is given to the integration of modern information and communication technologies (ICT) into the methodological preparation process. The findings indicate that the systematic application of the proposed technologies significantly enhances the level of methodological competence among future informatics teachers, improves their ability to design effective lessons, and fosters digital literacy skills. The results of the experimental work conducted at Namangan State University demonstrate the effectiveness of the proposed approach and confirm its relevance for contemporary teacher education.

Keywords: methodological training, informatics teacher, pedagogical technologies, digital education, competency-based approach, ICT integration, higher education, teacher preparation.

1. INTRODUCTION

The rapid development of digital technologies and the widespread integration of informatics into all spheres of modern life have significantly increased the demand for highly qualified informatics teachers. The quality of informatics education at school level is largely determined by the methodological competence of teachers — their ability to plan, organize, and evaluate the educational process in accordance with modern pedagogical standards and the needs of a digital society.

Despite substantial reforms in the higher education system of Uzbekistan, the methodological preparation of future informatics teachers remains one of the most challenging and underdeveloped areas. Many graduates of pedagogical faculties encounter difficulties in translating theoretical knowledge into effective classroom practice. The gap between academic preparation and practical teaching skills calls for the development and implementation of new technologies specifically targeted at building methodological competence.

This study aims to identify, develop, and empirically validate a set of pedagogical technologies that can effectively enhance the methodological training of future informatics teachers. The research is grounded in competency-based education theory, constructivism, and the principles of technology-enhanced learning.

2. LITERATURE REVIEW

Methodological training as a component of teacher education has been studied by numerous scholars worldwide. Shulman (1987) introduced the concept of 'pedagogical content knowledge', emphasizing that effective teachers must possess deep integration of subject matter and pedagogical expertise. This foundational idea has since been extended to informatics education by researchers such as Mishra and Koehler (2006), who proposed the Technological Pedagogical Content Knowledge (TPACK) framework.

In the context of informatics teacher education, researchers including Gal-Ezer and Harel (1998) and Hubwieser et al. (2013) have highlighted the importance of equipping future teachers with not only technical skills but also robust instructional design capabilities. Studies conducted in Central Asian educational contexts (Yusupova, 2019; Toshmatov, 2021) confirm that the methodological component of teacher preparation programs in Uzbekistan requires significant modernization to meet contemporary demands.

The application of project-based learning (PBL) in teacher education has demonstrated positive outcomes in terms of developing collaborative and problem-solving skills (Thomas, 2000). Similarly, simulation-based training and digital tools have been shown to enhance practical readiness among teacher candidates (Ertmer & Ottenbreit-Leftwich, 2010). These findings provide a theoretical basis for the present research.

3. RESEARCH METHODOLOGY

The study employed a mixed-methods research design combining quantitative assessment of methodological competence levels and qualitative analysis of the pedagogical process. The research was conducted at Namangan State University during the 2023–2024 academic year, involving 64 third- and fourth-year students of the Faculty of Informatics and Information Technologies.

Participants were divided into two groups: an experimental group (n=32) in which the proposed technologies were applied, and a control group (n=32) taught using traditional methods. The following data collection instruments were used: standardized methodological competence assessment scales, classroom observation protocols, reflective journals, and structured interviews with supervising teachers.

The experimental intervention consisted of three phases: (1) diagnostic phase — assessment of initial methodological competence levels; (2) formative phase — implementation of innovative pedagogical technologies; (3) summative phase — evaluation of outcomes and comparison between groups. Statistical analysis was performed using SPSS software, applying t-tests and descriptive statistics.

4. TECHNOLOGIES FOR DEVELOPING METHODOLOGICAL TRAINING

4.1. Project-Based Learning (PBL)

Project-based learning was introduced as a core technology in the experimental curriculum. Future informatics teachers were assigned to design complete lesson sequences on selected informatics topics, including lesson plans, worksheets, assessment tools, and multimedia materials. This technology promotes active learning, collaborative skills, and real-world application of methodological knowledge. Students were required to present their projects and receive peer and supervisor feedback, fostering reflective practice.

4.2. Case-Study Method

The case-study method was employed to develop analytical and decision-making skills. Students were presented with authentic classroom scenarios depicting common methodological challenges in informatics teaching, such as student misconceptions, differentiation for mixed-ability groups, and assessment dilemmas. Analysis and discussion of cases promoted the ability to apply

theoretical knowledge to practical situations and encouraged critical thinking about pedagogical choices.

4.3. Digital Simulation Environments

Virtual classroom simulation platforms were integrated into the preparation process to provide a safe practice environment. Students conducted micro-teaching sessions within digital environments, receiving automated and peer feedback on their instructional decisions. Simulation-based practice reduced anxiety associated with first real classroom experiences and allowed repeated rehearsal of specific methodological strategies, such as question formulation, pacing, and use of visual aids.

4.4. Competency-Oriented Instructional Design

A competency-oriented approach to curriculum design was adopted, aligning learning outcomes, instructional activities, and assessment tasks around clearly defined methodological competencies. Students learned to formulate measurable learning objectives, select appropriate teaching methods for different content types, and design formative assessment instruments. This technology ensured a coherent and structured development of methodological knowledge and skills throughout the course.

4.5. Integration of ICT Tools

Modern information and communication technologies were systematically embedded in the methodological training process. Future teachers acquired skills in using interactive whiteboards, e-learning platforms (Moodle, Google Classroom), programming environments for school-level informatics (Scratch, Python IDLE), and digital assessment tools. Emphasis was placed not only on technical proficiency but also on the methodological rationale for selecting and applying specific ICT tools in informatics lessons.

5. RESULTS AND DISCUSSION

The results of the experiment demonstrated a statistically significant improvement in methodological competence among students in the experimental group compared to the control group. Pre-test scores showed no significant difference between groups ($p > 0.05$), while post-test analysis revealed a substantial gap in favor of the experimental group ($p < 0.01$).

Table 1. Comparison of Methodological Competence Levels (Pre- and Post-Test)

Indicator	Control (Pre)	Control (Post)	Experimental (Pre)	Experimental (Post)
Lesson Design	3.1	3.4	3.2	4.6
Pedagogical Methods Use	2.9	3.3	2.8	4.5
Assessment Construction	2.7	3.1	2.8	4.4

The qualitative analysis of student reflective journals and interview data provided deeper insights into the learning process. Students in the experimental group reported increased confidence in lesson planning, improved understanding of the connection between theory and practice, and greater ability to adapt teaching strategies to student needs. The integration of ICT tools was particularly valued by participants, who noted that hands-on experience with digital teaching platforms was directly applicable to their future professional practice.

Observation data confirmed that students who underwent training with the proposed technologies demonstrated more varied and learner-centered instructional approaches during

teaching practice, as compared to peers from the control group, who tended to rely predominantly on explanatory and reproductive methods.

6. CONCLUSION

This study has demonstrated that the purposeful application of innovative pedagogical technologies — project-based learning, case-study method, digital simulation, competency-oriented instructional design, and ICT integration — significantly enhances the methodological training of future informatics teachers. The proposed technology complex addresses the identified gaps between theoretical preparation and practical teaching competence, equipping graduates with the skills needed to design and deliver effective informatics lessons in contemporary educational settings.

The findings of the experimental work at Namangan State University confirm the effectiveness of the proposed approach and support its broader implementation in higher pedagogical education programs. Future research should explore the long-term impact of methodological preparation technologies on actual teaching performance after graduation, as well as the adaptation of the proposed framework to other subject areas.

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