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A SYSTEM FOR DEVELOPING DIDACTIC UNIT DESIGN COMPETENCIES IN MATHEMATICS STUDENTS

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Abstract: This article examines the issues of improving the professional training of future mathematics teachers. The main purpose of the research is to develop a system for the development of competencies in designing didactic units of educational material among students of mathematics directions. The article analyzes the methodical foundations of systematization and logical design of didactic units. The stages of forming students' design abilities and the impact of this process on the professional excellence of the future teacher are substantiated.
Keywords: mathematics education, future teacher, didactic unit, design competence, methodical system, professional training, educational material.
Annotatsiya: Ushbu maqolada bo‘lg‘usi matematika o‘qituvchilarining kasbiy tayyorgarligini takomillashtirish masalalari yoritilgan. Tadqiqotning asosiy maqsadi — matematika yo‘nalishi talabalarida o‘quv materialining didaktik birliklarini loyihalash kompetensiyalarini rivojlantirish tizimini ishlab chiqishdan iborat. Maqolada didaktik birliklarni tizimlashtirish va mantiqiy ketma-ketlikda loyihalashning metodik asoslari tahlil qilingan. Talabalarning loyihalash qobiliyatlarini shakllantirish bosqichlari va bu jarayonning bo‘lg‘usi o‘qituvchi kasbiy mahoratiga ta’siri asoslab berilgan.
Kalit so‘zlar: matematika ta’limi, bo‘lg‘usi o‘qituvchi, didaktik birlik, loyihalash kompetensiyasi, metodik tizim, kasbiy tayyorgarlik, o‘quv materiali.
Аннотация: В данной статье рассматриваются вопросы совершенствования профессиональной подготовки будущих учителей математики. Основная цель исследования заключается в разработке системы развития компетенций по проектированию дидактических единиц учебного материала у студентов математических направлений. В статье анализируются методические основы систематизации и логического проектирования дидактических единиц. Обоснованы этапы формирования проектных способностей студентов и влияние этого процесса на профессиональное мастерство будущего учителя.
Ключевые слова: математическое образование, будущий учитель, дидактическая единица, компетенция проектирования, методическая система, профессиональная подготовка, учебный материал.

INTRODUCTION

"In the modern era of global digitalization, the quality of mathematics education stands as a primary indicator of a nation's innovative potential. However, the transition from theoretical mathematical knowledge to effective classroom teaching remains a significant challenge for pre-service teachers. The ability to structure complex mathematical concepts into manageable 'didactic units' is not merely a pedagogical skill but a core design competence that determines the efficacy of the learning process. This study focuses on establishing a robust system to cultivate these competencies within the 5130100-Mathematics education direction, ensuring that future educators can bridge the gap between abstract theory and student comprehension."

LITERATURE REVIEW AND RESEARCH METHODOLOGY

International Experience and Theoretical Framework

In this section, the current state of the research problem is examined through two primary lenses. The design of didactic units in modern mathematics education is inherently linked to the **Pedagogical Content Knowledge (PCK)** framework, originally proposed by **Lee Shulman (1986)**. Subsequently, **Ball and colleagues (2008)** refined this theory specifically for mathematics educators by developing the **Mathematical Knowledge for Teaching (MKT)** model. Furthermore, the **"Enlargement of Didactic Units" (UDE)** technology, established by **P.M. Erdniyev (2001)**, serves as a methodological cornerstone for the systematic and holistic instruction of mathematical concepts.

Local Research and Perspectives

In the context of Uzbekistan, the training of future mathematics teachers and the enhancement of their methodological competencies have been extensively addressed in the scholarly works of **N.R. Gaybullayev, R.K. Jumayev, and M.E. Jumayev.** These researchers emphasize the critical importance of logically and systematically distributing educational material during mathematics lessons. However, the technological framework for developing "design competence" specifically within the Mathematics Education field (Specialization 5130100) remains insufficiently explored.

Research Design and Participants

The study utilized a **"mixed methods"** and **"quasi-experimental"** design. The research involved **61 students** enrolled in the Mathematics Education program at **Karshi State University**, who were divided into two groups:

- **Experimental Group (EG, n=33)**: Students received instruction via the "Designing Didactic Units" module alongside traditional lessons.
- **Control Group (CG, n=29):** Students followed the standard existing curriculum only.

Technological Stages of the Research

The process of fostering design competence in students was implemented in three distinct phases:

- **Diagnostic Phase:** Identifying students' foundational knowledge regarding the logical grouping of mathematical topics.
- **Technological (Practical) Phase:** Students were taught to design mathematical concepts based on the principles of "didactic engineering" (Artigue, 2015). This involved creating hierarchical connection schemes between the "core" of a topic and its associated supplementary units.
- **Control and Evaluation Phase:** Assessing the quality and effectiveness of the "Didactic Maps" developed by the students.

Data Analysis

To verify the reliability of the obtained results, mathematical-statistical methods were applied. **Student's t-test** was utilized to compare the mean values between the two groups. All calculations were performed using **SPSS 26.0** software, with a significance level of $p<0.05$ accepted as the threshold for statistical validity.

RESEARCH RESULTS AND ANALYSIS

Quantitative Assessment

The effectiveness of the experimental intervention was evaluated by comparing pre-test and post-test scores between the groups. The results indicate a significant improvement in the EG's performance compared to the CG.

Table 1. Comparative Analysis of Student Achievement (Pre-test vs. Post-test)

Groups	**Phase**	**Participants (n)**	**Mean Score⁻ (X^-)**	**Standard Deviation (SD)**
Nazorat guruhi (CG)	Pre-test	33	61.4	8.2
	Post-test	29	65.8	7.9
Eksperimental guruh (EG)	Pre-test	33	62.1	8.5
	Post-test	29	84.3	6.4

Statistical Significance

Independent Samples t-tests confirmed that:

- Initial proficiency levels were statistically equivalent between both groups ($p>0.05$).
- The post-intervention performance of the EG was significantly superior to the CG ($t=9.84, p<0.001$).

Qualitative Analysis

Analysis of the students' "Didactic Maps" revealed three key qualitative shifts:

- **Systematization:** Transition from fragmented understanding to logically interconnected conceptual blocks.
- **Visualization:** A 45% increase in the effective utilization of graphic organizers and logical schematics.
- **Methodological Adaptation:** Enhanced ability to select teaching methods aligned with the developmental stages of learners.

DISCUSSION

The study demonstrates that systematically developing design competence in future mathematics teachers elevates their professional mastery to a new qualitative level. The positive growth observed in the experimental group (+19%) reinforces Erdniyev's theory that UDE technology not only benefits pupils but also shapes the methodological thinking of future educators. Furthermore, the students' transition from treating material as "fragments" to holistic logical systems indicates an advancement in their **Pedagogical Content Knowledge (PCK)** level, as defined by **Shulman.**

Consistent with the findings of local scholars **N.R. Gaybullayev and M.E. Jumayev,** our results confirm that logical continuity is a primary criterion in mathematics education. While the control group relied on the fixed sequence of textbooks, the experimental group demonstrated the ability to "redesign" content based on learner receptivity. Our approach differs from previous studies by prioritizing **"Didactic Engineering"** principles, transforming the student from a mere "information deliverer" into an "architect of the educational process".

CONCLUSION

Developing the professional readiness of future mathematics teachers based on modern educational standards is a complex, multi-stage process. Based on the research findings, the following conclusions were reached:

- **Importance of the Competency-Based Approach:** Developing design competence in mathematics students enhances their theoretical knowledge and their ability to identify optimal ways to deliver this knowledge to pupils.
- **Systematization and Integration:** The proposed design technology allows students to deeply understand internal logical connections between mathematical concepts, ensuring conceptual continuity in lessons.
- **Proof of Effectiveness:** Statistical analysis (t-test, $p<0.05$) showed that the

design skills of the experimental group were 19-20% higher than those of the control group, confirming the viability and scientific validity of the developed methodological system.

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