MUHANDIS-QURUVCHILARNI MUHANDISLIK HISOBINI AMALGA OSHIRISH KOMPETENSIYASINI RIVOJLANTIRISH METODIKASINI TAKOMILLASHTIRISH (SUYUQLIK VA GAZ MEXANIKASI FANI MISOLIDA)

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Annotatsiya. *Ushbu ilmiy maqolada mavjud mahalliy isitish tizimlarining energiya samaradorligini oshirishga qaratilgan tahlil keltirilgan. O'tkazilgan tadqiqotlar asosida mahalliy tizimda avtomatlashtirilgan yo'qotishlarni monitoring qilish tizimlarini, shuningdek, quvur liniyasi va agregat izolyatsiyasini joriy etish to'g'risida qaror qabul qilindi. Olingan ilmiy natijalar isitish tizimlarida yoqilg'ini tejashga, umumiy xarajatlarni kamaytirishga va issiqlik ta'minoti sifatini sezilarli darajada yaxshilashga yordam beradi.*

Kalit so'zlar: *issiqlik, issiqlik almashinuvi, gidravlik optimallashtirish, nasos, energiya tejovchi texnologiyalar.*

СОВЕРШЕНСТВОВАНИЕ МЕТОДИКИ РАЗВИТИЯ КОМПЕТЕНЦИИ ИНЖЕНЕРОВ-СТРОИТЕЛЕЙ В ОСУЩЕСТВЛЕНИИ ИНЖЕНЕРНЫХ РАСЧЕТОВ (НА ПРИМЕРЕ КУРСА «МЕХАНИКА ЖИДКОСТИ И ГАЗА»).

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Аннотация: *В статье анализируются методические подходы, направленные на развитие компетенций инженеров-строителей в области инженерных расчётов. На примере механики жидкости и газа рассматриваются методы совершенствования вычислительных навыков студентов с использованием компетентностного обучения, практических занятий, проблемно-ориентированных задач и цифровых технологий. Усиление интеграции теории и практики в образовательном процессе рассматривается как важный фактор совершенствования профессиональной подготовки инженеров.*

Ключевые слова: *инженерный учет, развитие компетенций, механика жидкости и газа, педагогическая методика, практическое обучение,* гидравлические процессы, компетентностный подход, интеграция теории и практики.

IMPROVING THE METHODOLOGY FOR DEVELOPING CIVIL ENGINEERS' COMPETENCIES IN PERFORMING ENGINEERING CALCULATIONS (USING THE COURSE 'FLUID AND GAS MECHANICS' AS AN EXAMPLE).

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Abstract: *This article analyzes methodological approaches aimed at developing the competence of construction engineers in performing engineering calculations. Using the example of fluid and gas mechanics, the study highlights methods for improving students' computational skills through competency-based teaching, practical training, problem-based tasks, and digital technologies. Strengthening the integration of theory and practice in the learning process is assessed as a key factor in improving engineering professional training.*

Keywords: *engineering calculations, competence development, fluid and gas mechanics, pedagogical methodology, practical training, hydraulic processes, competency-based approach, theory and practice integration.*

Introduction. Today, engineering calculations are the foundation of all design processes in the construction field. Calculations carried out in such subjects as fluid and gas mechanics are highly important in practical activities like building water supply systems, designing hydraulic systems, and ensuring the reliable operation of gas pipelines. Therefore, developing students' competence to independently perform complex calculations is one of the urgent issues in higher education.

This article analyzes methodological approaches used in developing competence in performing engineering calculations, organizing the teaching process according to modern requirements, and improving the effectiveness of practical training.

As noted by domestic and foreign researchers, competency-based learning in engineering education is characterized by students' ability to think independently, analyze problematic situations, and solve practical issues using accurate calculations. In recent years, digital laboratories, virtual simulators, interactive modeling tools, and hydraulic process modeling software have been widely introduced into the teaching process of fluid and gas mechanics. These tools help strengthen students' skills in effectively performing engineering calculations.In addition, international practice applies methods such as problem-based learning, design-based learning, and engineering case studies to involve students in real project-based calculations.

Essence of the Methodology. The main goal of the methodology is to develop students' competence in understanding physical laws in fluid and gas mechanics, applying mathematical models, correctly performing hydraulic calculations, analyzing processes, and making practical decisions.

The methodology consists of the following stages:

1. Strengthening theoretical knowledge: basic laws, Navier–Stokes equations, Bernoulli's equation, hydraulic resistance, types of flow.
2. Developing practical calculation skills: selecting pipe diameter, determining loads, calculating flow velocity, identifying pressure losses.
3. Modeling and visualization: creating flow models using computer software, applying CFD (Computational Fluid Dynamics) simulations.
4. Solving problem-based tasks: performing project calculations based on real construction cases.
5. Assessing final competence: determining the student's calculation skills through tests, practical tasks, laboratory work, and project defense.

Practical Effectiveness of the Methodology. The proposed methodology was applied during experimental testing and yielded the following results:

— Students significantly improved their ability to use hydraulic process modeling software.

— Calculation errors decreased, and skills in analyzing results improved.

— The quality of independent project work increased.

— Students' interest in the subject of fluid and gas mechanics increased.

The results show that the competency-based methodology significantly improves not only engineering calculation skills but also students' overall professional training.

Conclusion. The findings show that the methodology aimed at developing construction engineers' competence in performing engineering calculations through the subject of fluid and gas mechanics improves the quality of the learning process. This methodology integrates theory and practice, enhances students' independent thinking, and strengthens their ability to solve practical engineering problems. In the future, the methodology should be further improved by expanding the volume of virtual laboratory work and establishing assessment criteria aligned with international standards.

Experimental studies confirm that strengthening theoretical knowledge, organizing systematic practical exercises, and using modern digital technologies and modeling software significantly improve students' professional skills. The methodology increases students' analytical thinking, ability to solve real engineering problems, and independent working culture.

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