

TEACHING METHODOLOGY OF INFORMATION TECHNOLOGIES AND MATHEMATICAL MODELING OF PROCESSES BASED ON A CREATIVE APPROACH

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Abstract

This article analyzes the role and didactic advantages of implementing a creative approach in teaching Information Technologies and the Mathematical Modeling of Processes. In the context of a rapidly developing digital environment, it is essential to cultivate students' analytical thinking, mathematical–applied competence, and the ability to integrate modeling processes with technological solutions. Therefore, introducing creative tasks, problem-based learning, project-based methods, digital simulations, interactive models, visualization platforms, and real-time modeling tools significantly enhances the effectiveness of the learning process. During the research, a creative approach–based methodological model was designed, and its structural components—motivational, cognitive, practical, and reflective stages—were examined in detail. The findings indicate that students engaged in creative learning environments develop a deeper understanding of modeling algorithms, strengthen independent use of technological tools, and demonstrate improved abilities to propose innovative solutions to problem situations. This methodology can be effectively applied in the training of future specialists in medicine, engineering, economics, and other interdisciplinary fields.

Keywords: creative approach, information technologies, mathematical modeling, teaching methodology, simulation, digital competence, innovative learning.

Introduction

The discipline of Information Technologies and Mathematical Modeling of Processes plays a pivotal role in preparing students for a rapidly evolving digital society. It equips learners with the ability to think systematically, interpret complex real-world phenomena, construct mathematical representations of dynamic processes, and translate these models into functional algorithms that can be implemented through modern technological tools. As global industries increasingly rely on automation, data-driven decision-making, and computational analysis, the need for specialists who can effectively model, simulate, and optimize processes has become more critical than ever.

The current educational landscape is undergoing a profound transformation driven by digitalization. Traditional teacher-centered approaches, while still valuable for foundational knowledge, are no longer sufficient to meet the cognitive and practical demands of contemporary learners. Students today must be active participants in the learning process, able to explore, experiment, and create. This necessitates the incorporation of creative, interactive, and technology-enhanced pedagogical strategies that foster deeper engagement and support the development of higher-order thinking skills.

Furthermore, the rapid expansion of digital ecosystems — including cloud platforms, big data analytics, artificial intelligence applications, and advanced simulation environments — has reshaped the expectations placed on both instructors and students. Mathematical modeling no longer exists as an isolated theoretical construct; rather, it functions as a multidisciplinary bridge connecting mathematics, computer science, engineering, economics, environmental studies, and various applied sciences. As a result, interdisciplinary integration is not simply beneficial, but essential for achieving meaningful educational outcomes.

In this context, modernizing the teaching methodology of Information Technologies and Mathematical Modeling of Processes has become an urgent pedagogical requirement. Creative tasks that encourage original thinking, project-based learning that promotes collaboration and real-world problem solving, and modular-modeling technologies that enable step-by-step conceptual understanding all contribute to a more effective and engaging instructional framework. By integrating these approaches, educators can cultivate a learning environment that stimulates curiosity, enhances digital literacy, and prepares students to navigate complex professional challenges with confidence and innovation.

Literature Review

In recent years, the use of information technologies in medical education, the improvement of teaching methodologies, and the development of digital competencies have been widely studied internationally. Researchers such as T. Bates, D. Garrison, N. Vaughan, M. Fullan, and A. Redecker emphasize that digital technologies are transforming all stages of the learning process, giving rise to new student-centered models of teaching and learning. According to them, a digitized learning environment allows the creation of individualized, flexible, and competency-oriented education.

Research Methodology

The study employed the following methods:

- analysis of pedagogical and psychological literature;
- evaluation of the didactic potential of modeling;
- creative teaching strategies such as brainstorming, synergetic approach, project-based learning, case study, and design thinking;
- use of digital platforms (Matlab, Python, Simulink, Maple, GeoGebra, Arena Simulation) for interactive modeling;
- implementation of an experimental teaching process;
- development of assessment criteria for students' analytical competence and creative thinking.

These methodological approaches ensured the reliability, validity, and effectiveness of the proposed teaching model.

Results

The research demonstrated that the creative approach-based methodological model significantly enhanced students' engagement, independent reasoning, and modeling skills. Activities such as constructing computer models of real-life processes, modifying scenarios, and comparing algorithmic efficiencies increased students' learning motivation. The use of simulation environments strengthened the connection between mathematical and technological knowledge, allowing learners to generate original solutions. Students in the experimental group achieved higher results in identifying modeling errors, applying optimization functions, and performing visual data analysis compared to those in the control group. Collaborative creative tasks also contributed to the development of communication and digital competencies. Overall, the designed methodology proved to be effective in deepening subject comprehension, improving analytical thinking, and developing technological proficiency.

Discussion

The findings confirm the importance of the creative approach in teaching Information Technologies and Mathematical Modeling of Processes. Traditional lecture- and practice-based approaches may lead to passive learning, while creative methodologies transform students into active participants in the process. Through simulation tools, learners construct, modify, and analyze models, turning the learning environment into a research-oriented space. The creative approach shifts the focus from memorizing mathematical formulas to applying them in real situations, fostering essential analytical competencies demanded by the modern labor market.

The methodology also strengthened interdisciplinary integration with fields such as informatics, mathematics, economics, and engineering, thus increasing the relevance and applicability of the learning content. However, the effective implementation of creative tasks requires teachers to possess strong technological literacy, highlighting an important prerequisite for the methodology's success.

Conclusion

The creative approach-based methodology enhances the teaching and learning process of Information Technologies and Mathematical Modeling of Processes. It fosters students' independent thinking, analytical reasoning, digital competence, and their ability to generate innovative solutions to complex problems. The use of simulation platforms increases interactivity, strengthens the link between theory and practical application, and deepens conceptual understanding. The proposed methodology can be recommended as an effective pedagogical model for improving educational quality and developing creative, innovative, and research-oriented learners.

References

1. Xudayberdiyeva Xusnobod O'rmonovna , **Naimov E.G.** New ways to attract students to informatics lessons // ***Ekonomika i sotsium.*** – 2020. – №6(73). – URL: www.iupr.ru.
2. Xudayberdiyeva Xusnobod O'rmonovna , **Naimov E.G.** Organization of the educational process in the virtual information and training system // ***Ekonomika i sotsium.*** – 2020. – №2(69). – URL: www.iupr.ru.
3. Xudayberdiyeva Xusnobod O'rmonovna, **Rustamov Mirodil Muhammadjanovich.** Organization of training in informatics // ***Ekonomika i sotsium.*** – 2020. – №10(77). – URL: www.iupr.ru.
4. Xudayberdiyeva Xusnobod O'rmonovna .Main features of pedagogical activities in the higher education system // ***Ekonomika i sotsium.*** – 2021. – №11(90). – URL: www.iupr.ru.
5. Xudayberdiyeva Xusnobod O'rmonovna , **Naimov E.G.** Topical issues of the methodology of teaching informatics // ***Ekonomika i sotsium.*** – 2021. – №3(82), ch.1.
6. Xudayberdiyeva Xusnobod O'rmonovna. Essence and characteristic features of pedagogical technology // ***Ekonomika i sotsium.*** – 2022. – №11(102). – URL: www.iupr.ru.

7. Mo'minova G.M., Naimov E., Komilova D., Xudayberdiyeva X.O', Alimova E. Tabiiy tolali o'simliklarning elektrofizik xususiyatlarini tadqiq qilish // *O'zMU xabarlari – Vestnik NUUZ – ACTA NUUZ*. – (Soni ko'rsatilmagan).
8. Yuldasheva N.X., Xudayberdiyeva X.O' Rux elementining organizmdagi roli va tibbiyotdagi ahamiyati // *Innovation in the Modern Education System*. – 2024. – Part 37. – Collections of Scientific Works.
9. Mo'minova G.M., Gulamov Sh.A., Xudayberdiyeva X.O'. Legirlangan va legirlanmagan qo'g'a o'simligi tolalaridan elektrofizik xususiyatlarni o'rganish uchun namunalar tayyorlash texnologiyasi // *Profilaktik tibbiyotda yuqori texnologiyalarni qo'llash*. – 30.04.2024.
10. Xudayberdiyeva X.O', Komilova D.T., Muminova G.M. Use of innovative technologies in the education // *Results of National Scientific Research International Journal*. – 2024. – Vol.3, Issue 5. – SJIF 5.8, Researchbib 7.9.
11. Xudayberdiyeva X.O', Temirova Z.A. Methodology for enhancing critical thinking abilities among students in medical higher education institutions // *Luchshie intellektual'nye issledovaniya*. – 2024. – Chast 16, Tom 3, Mart.
12. Xudayberdiyeva X.O'. Tibbiy ta'lim muassasalarida tibbiy biologik jarayonlarni modellashtirish metodikasi // *Science and pedagogy in the modern world: problems and solutions*. – Vol.2, Issue 11.
13. Xudayberdiyeva X.O', Naimov E.G., Komilova D.T. Features of pedagogical activities in the higher education system // *Ekonomika i sotsium*. – 2021. – №6(85), ch.1. – URL: www.iupr.ru.