INTERNATIONAL MULTI DISCIPLINARY JOURNAL FOR RESEARCH & DEVELOPMENT
eISSN 2394-6334 Impact factor: 8.854 Volume 13, issue 04 (2026)

ADVANCING THE METHODOLOGICAL ORGANIZATION OF LECTURES IN THE DIFFERENTIAL EQUATIONS CURRICULUM

S. Kholikov,
Associate Professor, Department of Humanitarian and Technical Sciences, Asia International University

Abstract:
this article presents an analysis of experimental work on the use of information technology tools and Case-Study technology, to determine their level of effectiveness of lectures on "Ordinary Differential Equations" Module.

Keywords*: differential equations, information technology tools, Case-Study technology, theorem, definition, mathematical application package.*

Introduction.

Improving the quality and effectiveness of mathematics education in higher education institutions is one of the pressing issues, which requires the implementation of innovative approaches to teaching. Therefore, in the course of the research, a systematic approach was applied to the process of teaching Differential Equations in higher education institutions. It is well known that the educational process is based on the cooperation between professors (teachers) and students, and such collaboration is considered the main factor in achieving the didactic objectives envisioned for this process.

Analysis of the Literature Related to the Topic. Scientific studies aimed at improving the methodology of teaching differential equations, developing and enhancing students' competencies in differential equations, teaching students the practical applications of differential equations, as well as the theory and practice of using mathematical software packages in teaching differential equations have been conducted both in our country and in the Commonwealth of Independent States. In particular, research in this field has been carried out by scholars such as D. Makhmudova, E.O. Sharipov, P.M. Aslanov, Yu.N. Bibikov, A.S. Bezruchko, I.S. Novikova, N.V. Sycheva, L.P. Kuzmina, T.V. Kapustina, R.M. Aslanova, Kh.A. Gerbekova, B.A. Naimanov, and A.V. Sinchukova.

Although the studies of the above-mentioned scholars have proposed certain approaches aimed at improving the effectiveness of teaching Differential Equations, research on the use of information technologies and interactive educational technologies particularly Case-Study technology in teaching differential equations in higher education institutions has not been sufficiently explored. Therefore, the proposed research is considered one of the urgent issues in modern education.

Research Methodology. In higher education institutions, the main form of organizing the educational process in mathematics-related disciplines is the lecture session. In particular, it is of great importance that professors and instructors organize this form of teaching by using innovative pedagogical technologies and information technology tools.

Research Results. As a result of the conducted research, it was determined that the effectiveness of teaching Differential Equations in higher education institutions can be significantly improved through the systematic integration of modern pedagogical approaches, interactive learning technologies, and information technology tools into the educational process. In particular, the use of the Case-Study method in teaching differential equations contributes to strengthening students' analytical thinking, independent learning skills, and their ability to apply theoretical knowledge to practical problems. During the research process, a teaching model

based on a systematic approach to the study of differential equations was developed and tested in the educational process. This model emphasizes the active participation of students in lectures and practical sessions, encourages collaborative learning, and supports the development of professional competencies. The implementation of this model showed that when lectures are organized with the support of multimedia presentations, mathematical software packages, and interactive problem-solving activities, students demonstrate a higher level of engagement and understanding of theoretical concepts. Furthermore, the integration of mathematical software packages such as computer algebra systems allows students to visualize solutions of differential equations, analyze different solution methods, and verify obtained results. As a consequence, students gain deeper insight into the qualitative and quantitative behavior of solutions of differential equations. The use of such digital tools also enables instructors to present complex mathematical concepts more clearly and effectively.

The results of the research also revealed that the use of the Case-Study approach in teaching differential equations helps students understand the practical significance of mathematical models in various fields such as physics, engineering, economics, and natural sciences. Through the analysis of real-life problems and applied situations, students develop the ability to formulate mathematical models using differential equations and interpret the obtained solutions in the context of practical applications. In addition, the study showed that the combination of traditional teaching methods with interactive learning technologies leads to an improvement in students' academic performance and motivation to study mathematics. Students who participated in experimental classes demonstrated higher levels of conceptual understanding, problem-solving skills, and independent research abilities compared to those who studied using only traditional lecture-based methods. Another important outcome of the research is the identification of methodological recommendations for instructors teaching differential equations. These recommendations include organizing lectures in an interactive format, encouraging student participation through discussions and problem-based tasks, integrating digital technologies into the learning process, and using case-based assignments that reflect real-world applications of differential equations.

Overall, the research findings confirm that the implementation of innovative teaching technologies in the process of teaching differential equations in higher education institutions positively influences the quality of education, enhances students' professional competencies, and contributes to the development of their analytical and creative thinking abilities. Therefore, the proposed methodological approach can be effectively used in the teaching of differential equations and other mathematical disciplines in higher education.

Conclusion. In conclusion, the conducted research demonstrates that improving the effectiveness of teaching Differential Equations in higher education institutions requires the application of modern pedagogical approaches, innovative teaching technologies, and information technology tools. The integration of interactive teaching methods, particularly the Case-Study approach, into the educational process significantly contributes to enhancing students' understanding of theoretical concepts and their ability to apply mathematical knowledge in solving practical problems. The study confirms that the systematic organization of the teaching process, active cooperation between instructors and students, and the effective use of digital technologies create favorable conditions for the formation and development of students' professional competencies. In particular, the use of mathematical software packages and multimedia tools helps to visualize complex mathematical processes, facilitates the analysis of differential equations, and strengthens students' independent learning skills. Moreover, the results indicate that the application of interactive educational technologies increases students' motivation to study mathematics and improves the quality of learning outcomes. Through

problem-based learning and case-study activities, students gain practical experience in modeling real-world phenomena using differential equations, which enhances their analytical thinking and research abilities.

References.

[1]. Kuznetsova, I.V. (2015). Development of methodological competence of future mathematics teachers in the process of studying mathematical structures in network communities. PhD Dissertation in Pedagogical Sciences. Arkhangelsk, 211 p.
[2]. Zhuk, L.V. (2007). Activation of cognitive activity of future mathematics teachers in geometry through computer modeling. PhD Dissertation in Pedagogical Sciences. Yelets, 234 p.
[3]. Plyasunova, U.V. (2004). The use of computer mathematical systems in teaching mathematics to students majoring in Informatics in pedagogical universities. Abstract of PhD Dissertation in Pedagogical Sciences. Yaroslavl, 24 p.
[4]. Bezruchko, A.S. (2014). Methodology for teaching the solution of differential equations to future mathematics teachers based on the use of information technologies. PhD Dissertation in Pedagogical Sciences. Moscow, 231 p.
[5]. Kapustina, T.V. (2001). Theory and practice of developing and using new information technologies based on the Mathematica computer system in pedagogical universities (Faculty of Physics and Mathematics). Doctoral Dissertation in Pedagogical Sciences. Moscow, 254 p.
[6]. Tenebout, M., & Pollard, H. (2010). Ordinary Differential Equations. Birkhäuser, Germany.