СЕКЦІЯ: STEM-ОСВІТА: ШЛЯХИ ВПРОВАДЖЕННЯ, АКТУАЛЬНІ ПИТАННЯ ТА ПЕРСПЕКТИВИ

STEM EDUCATION AS A KEY FACTOR IN EDUCATIONAL INNOVATION

Sulymka Anastasiia
Applicant for the first level of higher education in the specialty of Secondary Education (Informatics)
Ternopil Volodymyr Hnatiuk National Pedagogical University
sulymkaanastasia@gmail.com
Skaskiv Hanna
Assistant of the Department of Informatics and Methods of its Teaching
Ternopil Volodymyr Hnatiuk National Pedagogical University
skaskivg@tnpu.edu.ua

In this era of global technological change and the digital transformation of the economy, STEM education (Science, Technology, Engineering, Mathematics) serves not merely as an educational discipline, but as a strategic tool for ensuring national competitiveness. International practice convincingly demonstrates that the integration of science, technology, engineering and mathematics is a key driver of innovation, enabling the training of specialists capable of solving complex interdisciplinary problems. However, the successful realisation of this potential is impossible without overcoming structural barriers, in particular the gender gap, which limits access for a significant portion of human capital to innovative sectors.

The relevance of this research stems from the need to align the Ukrainian education system with global trends in sustainable development. The issue of gender equality in STEM is integrated into the UN 2030 Agenda for Sustainable Development, which underscores its global significance. For Ukraine, in the context of implementing the Association Agreement with the EU, the development of STEM education is critical for ensuring equal opportunities in professional life and stimulating economic recovery through innovation [1].

Research into the origins and development of STEM education draws on a wealth of international and domestic experience. Historical aspects of supporting women in technical fields, particularly the roles of Virginia Gildersleeve and Mary ‘Polly’ Bunting-Smith in the US, demonstrate an evolution from isolated initiatives to systematic lobbying for women’s rights through organisations such as the AAUW and the Society of Women Engineers (SWE). UNESCO’s global strategies, outlined in the ‘Cracking the Code’ programme, focus on deconstructing the social and psychological factors that deter girls from studying science. An important theoretical contribution is the study of the ‘gender equality paradox’, which suggests that in the most socially developed countries (e.g. Norway, Finland), the gender gap in STEM may be paradoxically large due to girls’ free choice in favour of fields where they have a relative advantage, particularly the humanities [3].

Despite the existence of general strategies, Ukrainian academic discourse has not sufficiently addressed the mechanisms for the practical adaptation of successful international models (such as the Australian Elevate programme) to the conditions of wartime and post-war situations. The issue of the effectiveness of engaging young people from rural areas in STEM projects and the long-term impact of domestic mentoring programmes on the career progression of female graduates, compared to state initiatives, also requires deeper analysis.

The aim of this work is to substantiate the role of STEM education as a factor in innovative development, to analyse international and national strategies for overcoming gender barriers in this field, and to identify promising directions for the modernisation of Ukrainian education.

Global strategies for developing STEM as a tool for innovation. International experience shows that STEM education requires significant investment and long-term planning. An example of a large-scale government initiative is Australia, where the government has allocated $41 million to the Elevate programme. This initiative involves providing 500 scholarships for women at all levels — from undergraduate to leadership positions — with a particular focus on non-binary groups and women from regional areas. This highlights that innovation in education lies in engaging the widest possible range of talent.

National context: from declarations to practice. In Ukraine, the process of transforming STEM education has gained momentum following the adoption of the 'Strategy for the Implementation of Gender Equality in Education by 2030'. An important step is the work of the National Research Foundation of Ukraine (NRFU), which has introduced an action plan for 2023–2026 to support female researchers in balancing their careers with family responsibilities. However, there is a certain gap between government planning and reality: experts note that official figures on the recruitment of girls into STEM are often underestimated (around 175 per year), whilst actual market demand and the number of female students in IT courses are already in the thousands [2].

The role of community and charitable initiatives. With limited state resources, civil society projects are becoming key drivers of innovation. Through its educational modules on robotics and biotechnology, the STEM IS FEM project not only provides technical knowledge but also develops the soft skills necessary for leadership. The 'Girls in STEM' and TechNovations initiatives implement an innovative mentoring approach, where successful women act as role models, breaking down the stereotype of STEM as an exclusively 'male domain'. Information campaigns, such as the 'Top 20 Inspiring Women in STEM' publication, shape a new social narrative, which is a prerequisite for innovative changes in education [4].

Methodological modernisation of the learning environment. The innovative nature of STEM education requires a re-evaluation of teaching approaches themselves. This includes creating a gender-balanced environment where curricula are free from stereotypical tasks that assign women solely domestic roles and men high-tech fields. It is important to involve female lecturers in technical disciplines to ensure balanced representation.

STEM education is a critical factor in the innovation of modern education, as it builds a talent pool for the most technology-intensive sectors of the economy. However, the effectiveness of STEM approaches depends directly on the system's inclusivity and its ability to overcome gender stereotypes. International experience (USA, Australia) shows that success is achieved through a combination of state funding, mentoring and active support from scientific communities. In Ukraine, despite progressive strategies, the main burden of promoting STEM currently falls on charitable projects, which requires greater cooperation between the state, business and the civil society sector.

Prospects for further research. Future research should focus on developing tools to assess the effectiveness of implementing gender-sensitive methodologies in higher education institutions. It is also important to explore the potential of digital platforms for scaling up STEM projects in de-occupied territories and regions with limited access to educational infrastructure.

References

1.English L. D. STEM education K-12 : Perspectives on integration. International Journal of STEM Education, 2016. № 3(3), v. 1–11. DOI: 10.1186/s40594– 016-0036-1 (accessed: 23 March 2026).

2. STEM-osvita: Instytut modernizatsii zmistu osvity. [STEM education: Institute for Modernization of Education Content]. URL: https://imzo.gov.ua/stem-osvita (accessed: 25 March 2026).

3. UNESCO. Cracking the code: Girls' and women's education in science, technology, engineering and mathematics (STEM). Paris : UNESCO Publishing, 2017. 159 p. (accessed: 26 March 2026).

4. UNSPECIFIED (2018) The Gender-Equality Paradox in Science, Technology, Engineering, and Mathematics Education. Psychol Sci. ISSN 1467-9280 DOI: https://doi.org/10.1177 /0956797617741719 (accessed: 28 March 2026).

APPLICATION OF COMPUTER TECHNOLOGIES AND OPTIMIZATION APPARATUS TO CLASSICAL PROBLEMS OF LINEAR ALGEBRA

Tsukanova Alisa
candidate of Physics and Mathematics, assistant of Department of Mathematical Physics and Differential Equations
National Technical University of Ukraine «Igor Sikorsky Kiev Polytechnic Institute»
ponochka2511@ukr.net

Any process of decision making involves selecting from various alternatives. This choice is governed by our desire to make the most effective, the most optimal decision. Thus, at the heart of any decision-making process, be it in engineering or in economics, always lies optimization. Mathematical optimization is one branch of applied mathematics, focused on finding the best solution from a set of feasible alternatives, often subject to constraints. It is foundational in engineering, economics, data science, and operations research. Optimization problems of various types arise in all quantitative disciplines, ranging from computer science and engineering to operations research and economics. Optimization modeling is rather powerful tool, used, including, in classical mathematics, for instance, in linear algebra. Applied linear algebra allows us to take some radically different look at many classical problems of mathematics [3], that is demonstrated in this paper.

It presents basic results of analysis of classical Gaussian elimination method [1; 4] and gradient methods, as well as their variations [2; 5], for solving arbitrary systems of linear algebraic equations. These results have been obtained after testing our own program, written in «Visual Basic for Applications». Namely, we have combined well-known methods from classical algebra and six optimization methods.

Today, with active use of computers in different areas of our life, we have to admit that computer methods give us innovative, truly non-standard, way to look at different problems from classical mathematics. In particular, even the simplest problems of linear algebra from now on are not just routine tasks for students and can be considered from a different angle via modern technologies. Linear algebra is, probably, the most fundamental tool for machine learning, providing indeed powerful and versatile framework for representing, analyzing, and manipulating data. Its broad applicability to truly wide spectrum of machine learning tasks makes it indeed indispensable skill for professionals in the corresponding field.