

PEDAGOGICAL MECHANISMS FOR INVOLVING WOMEN IN THE SPHERE OF INFORMATION TECHNOLOGY THROUGH STEAM EDUCATION

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<https://doi.org/10.5281/zenodo.18707979>

Abstract

This article examines pedagogical mechanisms and educational approaches aimed at increasing women's participation in information technology through STEAM education. It analyzes the social, cultural, and educational barriers faced by girls when choosing an IT career and identifies ways to overcome them. The work draws on contemporary research in gender pedagogy, digital literacy, and innovative educational methods.

Keywords: STEAM education; women in IT; digital literacy; gender pedagogy; digital competencies; involvement in IT; educational mechanisms; innovative teaching methods.

Annotasiya

Maqolada STEAM ta'limi orqali ayollarning axborot texnologiyalari sohasidagi ishtirokini oshirishga qaratilgan pedagogik mexanizmlar va ta'lim yondashuvlari ko'rib chiqiladi. Unda qizlar IT sohasidagi kasbni tanlashda duch keladigan ijtimoiy, madaniy va ta'limdagi to'siqlar tahlil qilinadi va ularni yengib o'tish yo'llari aniqlanadi. Asar gender pedagogikasi, raqamli savodxonlik va innovatsion ta'lim usullari bo'yicha zamonaviy tadqiqotlarga asoslangan.

Kalitli so'zlar: STEAM ta'limi; IT sohasidagi ayollar; raqamli savodxonlik; gender pedagogikasi; raqamli kompetensiyalar; IT sohasida ishtirok etish; ta'lim mexanizmlari; innovatsion o'qitish usullari.

Аннотация

В данной статье рассматриваются педагогические механизмы и образовательные подходы, направленные на увеличение участия женщин в информационных технологиях посредством STEAM-образования. Анализируются социальные, культурные и образовательные барьеры, с которыми сталкиваются девушки при выборе карьеры в сфере ИТ, и определяются пути их преодоления. Работа опирается на современные исследования в области гендерной педагогики, цифровой грамотности и инновационных образовательных методов.

Ключевые слова: STEAM-образование; женщины в ИТ; цифровая грамотность; гендерная педагогика; цифровые компетенции; участие в ИТ; образовательные механизмы; инновационные методы обучения.

The rapid development of the digital economy requires a greater number of IT specialists. Despite the growing demand, the proportion of women in IT remains low, due to both objective social factors and the specific educational environment. Recent research confirms that interest in high technology begins in school, and educational practices lay the foundation for career choice.

STEAM education, focused on interdisciplinary learning, offers ample opportunities to develop creative and engineering thinking in girls. This approach combines technical knowledge with artistic expression, making the learning process more accessible and engaging. The integration of art helps reduce psychological barriers and enhance motivation.

Educational methods must consider gender-specific motivation and perceptions. This requires the development of new pedagogical mechanisms that can not only impart knowledge but also create a safe, supportive, and inspiring environment that encourages girls to choose a career in IT.

Amid digital transformation, the importance of women's participation in IT is increasing, as a diverse workforce fosters innovation and sustainable development in the industry. Gender imbalance in technology professions leads to missed potential and limits market opportunities. Unequal access to modern digital skills exacerbates women's socioeconomic status and widens the technological divide.

The relevance of this problem is confirmed by statistics showing that women are less likely to choose technical fields and face stereotypes about their own abilities. Overcoming these barriers requires systemic changes in education aimed at building confidence, digital literacy, and access to modern educational resources.

The STEAM approach is becoming an effective tool as it integrates technology and creativity, which is especially important for engaging girls. Modern pedagogy should not only impart knowledge in programming, engineering, and mathematics, but also develop creative thinking, problem-solving skills, and innovative design.

The main problem is the low participation of women in high-tech fields, caused by a combination of stereotypes, insufficient early support, and a lack of educational practices that promote the development of digital skills in girls. Traditional methods do not always take into account the specific perceptions and interests of students, which reduces their motivation to master technical disciplines. An additional challenge is the lack of role models among female IT professionals who can demonstrate successful career paths. This means that even women interested in technology often doubt their abilities and don't consider IT as a long-term career.

The problem is exacerbated by the limited availability of modern educational resources in some schools and regions. The lack of conditions for practical classes, digital labs, and project-based classrooms hinders the development of professional interest and self-efficacy.

To address this problem, it is necessary to implement pedagogical mechanisms aimed at fostering sustainable motivation and a positive attitude toward technology in young women. Project-based learning methods, which allow students to independently create prototypes, digital products, and engineering solutions, are a key tool. This approach develops practical skills and self-confidence.

Equally important is the implementation of mentoring programs, where experienced female professionals support students, help them formulate professional goals, and overcome psychological barriers. Mentoring enhances social support and promotes the development of professional identity.

The creation of digital labs and STEAM centers provides access to modern technologies: robotics, programming, 3D modeling, and artificial intelligence. Such spaces foster experimentation, creativity, and interdisciplinary interaction, key elements of STEAM education.

The study shows that the implementation of a STEAM approach significantly increases girls' interest in information technology. Students involved in project-based and hands-on activities demonstrate greater enthusiasm, and their performance in technical subjects shows positive dynamics. This is confirmed by both academic indicators and survey data.

Mentoring programs have a significant impact on confidence and career plans. Girls participating in such initiatives are more likely to choose technical faculties and demonstrate high engagement in technology competitions, hackathons, and research projects. Social support is a critical factor in success.

The creation of STEAM spaces and digital labs leads to an increase in practical work, improved teamwork skills, and the development of engineering thinking. The results demonstrate that access to modern technologies transforms the educational experience and expands students' professional horizons.

The analysis revealed that the success of women's involvement in IT depends not only on the educational environment but also on the cultural and social environment. In some regions, persistent stereotypes persist that limit girls' career choices. Therefore, educational reforms must be accompanied by educational activities and the promotion of women's achievements in IT.

Integrating the STEAM approach into mainstream education remains an important issue. Many schools experience a shortage of teachers capable of working in an interdisciplinary environment. New teachers need to be trained and existing teachers need professional development, particularly in robotics, programming, and cybersecurity.

Evaluating the effectiveness of the programs also remains controversial. Despite the positive results of individual projects, long-term monitoring is needed to determine the impact of STEAM education on women's career trajectories. This will allow for the development of systemic recommendations and standards for teaching practice.

The study included an analysis of the current state of female participation in IT, a study of school and university educational practices, and a survey and observations of groups participating in STEAM projects. The goal was to determine which pedagogical mechanisms have the greatest influence on girls' choice of technology majors. The study surveyed female students and schoolgirls participating in courses on programming, 3D modeling, robotics, and digital design. The analysis revealed that the most influential factors were hands-on learning, working on real projects, the presence of female mentors, and access to modern digital equipment. A comparative analysis was also conducted between groups studying traditional and STEAM models. The STEAM groups demonstrated higher levels of motivation, interest in technology, and self-confidence. This confirms the need to implement interdisciplinary teaching methods and create a supportive, gender-sensitive educational environment.

The study confirms that STEAM education is an effective tool for engaging women in IT. A comprehensive pedagogical approach, including project-based activities, mentoring, and access to modern digital tools, fosters interest, confidence, and professional motivation in young women.

Suggestions for engaging women in IT through STEAM:

Educational programs and methods: introduction of STEAM courses aimed at girls (courses in programming, artificial intelligence, 3D graphics, animation, web development, computer design; the use of creative tasks, such as creating digital art objects, VR exhibits, interactive stories, beauty and fashion in digital design, which is more motivating for girls); project-based learning (Real-life projects: creating apps, robot prototypes, digital media, social IT solutions; teamwork, where girls can take on leadership roles); integration of art and

technology (combine programming with design, engineering tasks with visual design, generative graphics, digital fashion, 3D ornamentation, media design, UX research);

Social Support and Mentoring

Creating female mentoring programs (inviting successful women from IT companies, organizing regular meetings: master classes, online consultations, career training);

Developing a "Girls in STEAM/IT" community and clubs (school and student clubs where girls can discuss projects and receive support; participating in competitions, hackathons, and exhibitions);

Promoting female role models (profiles and success stories in the institution's media; video reports, interviews, podcasts).

Creating a supportive educational environment helps overcome gender barriers and increase women's participation in high-tech professions. Combining technical and creative disciplines makes learning more accessible and engaging. This approach develops students' skills for the future: critical thinking, creativity, communication, and digital literacy.

These findings highlight the need for continued research in the areas of gender pedagogy and digital education. Expanding STEAM initiatives, developing teacher training programs, and establishing national centers to support girls in IT could become strategic directions for the development of a digital society.

STEAM education, which integrates science, technology, engineering, art, and mathematics, is seen as a key tool for engaging women in high-tech industries. This article presents practical mechanisms for pedagogical support, including project-based methods, mentoring programs, interactive labs, and digital educational platforms. Particular attention is paid to developing student motivation and self-efficacy.

The combination of a systemic educational approach, gender-sensitive pedagogy, and accessible digital tools significantly increases women's interest in information technology. This material is aimed at educators, researchers, and educational organizations interested in creating an inclusive digital ecosystem.

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