

THE RELEVANCE, ACHIEVEMENTS AND CHALLENGES OF WOMEN'S PARTICIPATION IN STEM IN UZBEKISTAN ANALYSIS AND CONCLUSIONS

Nargiza Maxsatjonovna Xasanova,

Head of the Department of 'Methodology of Socio-Economic Sciences',
Andijan Regional Pedagogical Skills Center, Doctor of Philosophy (PhD).

Abstract

The article analyzes the importance of women's active participation in science and technology, especially in STEM (Science, Technology, Engineering, and Mathematics), the state policies and initiatives being implemented in this regard, the achievements and challenges in ensuring gender equality in each area, as well as the impact of women's participation in science on the socio-economic development of society.

Keywords: Science, technology, women, gender equality, scientific development, STEM, socio-economic policy, innovations, technological progress, scientific discoveries, grants, involvement in science, technological achievements.

Introduction

Science is not only the foundation of progress but also a means of facilitating human understanding of the world, improving quality of life, and fostering development. New research, laboratory experiments, theoretical and practical developments serve as the basis for future technologies. For instance, achievements in artificial intelligence, quantum computers, or genetic engineering, particularly in the STEM fields, are grounded in the maturity of today's science.

Today, when new innovations in science are applied in practice, they are not merely ideas but must serve to transform lifestyles and improve living standards. That is, they should enhance economic efficiency, improve the quality of life, solve environmental issues, and play an important role in modernizing the education system.

Any such change is directly linked to the activities of intelligent, knowledgeable, and creative individuals with high intellectual capacity. In this process, women play a crucial role. Their initiatives and inventions are particularly valuable because they not only solve problems but also provide creative, humanitarian, and sustainable solutions, adapting to existing conditions and opportunities. Their creativity, technological literacy, and initiative are driving significant changes in society.

Discussion

The opportunities created for women in Uzbekistan and their contributions to science and technology are steadily growing. Today, there are 1,489,000 students in higher education institutions, of which 782,000, or 52.5%, are women. These figures show that women's interest in higher education is increasing year by year. On the one hand, this reflects the determination and enthusiasm of women on the path of knowledge, while on the other hand, it is the result of



state policies aimed at expanding women's access to higher education.

Especially at the master's level, the proportion of female students is high. Currently, 62.44% of master's students are women. The government's decision to cover the tuition fees for female master's students opened great opportunities for them. Today, more than 6,200 women are engaged in scientific activity, and 25% of research output is produced by female scientists, which indicates their strengthening role in society.

In today's rapidly changing world, with global transformations, new innovations, inventions, and discoveries are in demand. The STEM fields (science, technology, engineering, and mathematics), which are developing at high speed, require talented, qualified, and motivated youth to introduce new ideas and solutions into life. Research shows that STEM is the future!

STEM education is an integrated approach that combines science, technology, engineering, and mathematics. Later, elements of art and reading were added, expanding the system into STEAM education. STEM education is believed to have originated in the 1990s in the United States, though some sources indicate it began earlier. The active development of STEAM education gained momentum after the launch of the Soviet satellite in 1957.

The main goal of STEAM education programs is to teach students innovative thinking, critical analysis, and creative problem-solving using engineering or technology for real-life challenges. Emphasis is placed on applying mathematics and natural sciences in practice.

Today, STEM education is actively developing not only in the USA and Europe but also in CIS countries, including Kazakhstan and Uzbekistan.

According to research, the motivation for choosing STEM careers peaks during adolescence. Factors such as self-awareness, self-development, growth opportunities, and society's attitude toward STEM play a decisive role in career choice. Psychological aspects, such as strong social support, are critical in making firm decisions about STEM fields.

Results. According to UNESCO (2021), women make up 28% of engineering specialists, 40% of computer science graduates, and 22% of artificial intelligence specialists worldwide. A global study by the OECD revealed that only 1% of 15-year-old girls expressed interest in pursuing ICT as a profession, compared to 5.5% of boys. In Uzbekistan, despite stereotypes that hinder girls from choosing STEM, their participation in these fields is growing. According to the State Statistics Agency, the share of women among graduates of scientific, technological, engineering, and mathematics programs rose from 32.6% in 2017 to 40.2% in 2021. In 2022, women accounted for 27.3% of graduates in natural sciences, mathematics, statistics, ICT, engineering, manufacturing, and construction.

However, research highlights a key problem: many young girls lack positive female role models in STEM. School-aged girls often do not choose natural sciences and technology. Due to cultural and traditional influences, many women are more accustomed to working in community-based environments than in technical fields.

Although many girls are interested in STEM careers, for various reasons they deny their aspirations or hesitate to take the first steps. As a result, only 21% of university graduates in STEM are women, and fewer than 30% of PhD holders in natural sciences and technical fields are women.

Nevertheless, history records the invaluable contributions of female scientists and engineers who have left an indelible mark.



Therefore, to address challenges in this area, the government of Uzbekistan is implementing a number of policies and initiatives to encourage women's participation in scientific research and technology. For example, grants and scholarships are being allocated to support women's research activities. Moreover, programs aimed at involving women in STEM fields are being expanded.

Conclusion

Women's successful careers in science and technology not only expand their personal opportunities but also bring benefits to society and the economy. Attracting women into these fields is crucial from the perspective of gender equality. Science and technology are the primary drivers shaping every sector of society today. If women are not sufficiently involved in these fields, scientific discoveries and technological progress cannot be fully realized. Research indicates that expanding women's participation in the labor market and science accelerates socio-political and economic development. This strategy can increase GDP growth by 5.3% annually and contribute to positive social change.

Recommendations for increasing women's participation in STEM:

- Eliminate stereotypes, social norms, and discriminatory attitudes toward women in STEM fields;
- Encourage girls and young women to engage more in primary, secondary, technical, and vocational education in STEM and support them to pursue higher education at all levels;
- Ensure gender equality in professional achievements, scientific entrepreneurship, and innovation;
- Support internships abroad for female students in STEM to broaden their perspectives and promote STEM-focused programs featuring successful women as role models (e.g., TV programs, TED Talks);
- Encourage continuous self-development, reflection, self-management, and productivity among women in STEM to ensure long-term success.

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