GENDER DIMENSION IN STEM EDUCATION IN THE REPUBLIC OF MOLDOVA: EFFORTS AND TRENDS

Victoria Lisnic

Legal Political and Sociological Research Institute, Republic of Moldova
E-mail: victorialisnic08@yahoo.com

(Received, 20 March, 2023)

https://doi.org/10.53081/mjps.2023.22-1.08

Abstract

By encouraging girls and women to develop and maintain an interest in STEM subjects, we are preparing the next generation of researchers, engineers, scientists and programmers to meet the growing demand for skilled STEM professionals. Current and future jobs and societal challenges require and will increasingly require a wide range of skills such as teamwork, intercultural competence, empathy, creativity, problem solving and independent non-linear thinking. Accordingly, we must ensure that women and girls are widely represented at all levels as we move forward. It is more important than ever that we eliminate stereotypes and biases and promote women and girls who want to pursue STEM careers.

Keywords: STEM, education, gender, segregation, stereotypes.

Rezumat

Încurajând fetele și femeile să dezvolte și să mențină interesul pentru subiectele STEM, pregătim următoarea generație de cercetători, ingineri, oameni de știință și programatori pentru a răspunde cererii tot mai mari de profesioniști calificați în STEM. Locurile de muncă actuale și viitoare și provocările societale necesită și vor necesita din ce în ce mai mult o gamă largă de abilități, cum ar fi munca în echipă, competența interculturală, empatia, creativitatea, rezolvarea problemelor și gândirea independentă neliniară. În consecință, trebuie să ne asigurăm că femeile și fetele sunt reprezentate pe scară largă la toate nivelurile pe măsură ce avansăm. Este mai important ca oricând să eliminăm stereotipurile și părtinirile și să promovăm femeile și fetele care doresc să urmeze cariere STEM.

Cuvinte cheie: STEM, educație, gen, segregare, stereotipuri.

1. Introduction

The current global trends of the transition from the industrial society to the information society and Industry 4.0 constitute a revolutionary global change comparable to the emergence of the steam engine in the 19th century, electricity in the first half of the 20th century and the Internet in the late 20th century. Global societies are becoming more advanced and technology is more integrated into a daily life than ever before. World moves to an increasingly digital

economy and closing the global gender gap in science, technology, engineering and mathematics (STEM) education is critical to empowering women economically and addressing the shortage of skilled people needed to meet the growing demand for technology jobs. Recent studies show that closing the gender gap in STEM education fields could help reduce labor market bottlenecks, increase women's employment and productivity, and reduce occupational segregation. Ultimately, this would stimulate economic growth both by increasing productivity and increasing labor market activity.

2. STEM Disciplines

The acronym STEM refers to a number of academic disciplines such as science, technology, engineering and mathematics, intended to make a beneficial and significant contribution to the training provided by the education system in these fields. They ensure workforce development by shaping the vision of students according to market demands. STEM education changes society by giving learners a new mindset and skills valued in any profession. They allow learners to be flexible, look for patterns, find connections and evaluate information. STEM education develops critical thinking, increases scientific literacy and empowers the next generation of innovators. It should be noted that there is also the STEAM initiative, proposed by Georgette Yakman, which introduced art among these subjects, considering that there is a link between them that corresponds to the global socioeconomic system [1].

3. STEM Learning

STEM education gives people skills that make them more employable and ready to meet the current labor demand. However, despite good employment opportunities and highly productive jobs in this area, there is currently a low proportion of women studying and graduating in STEM subjects. Although education is one of the most critical areas of women's empowerment, socio-economic barriers and negative stereotypes are still prevalent when it comes to STEM. This gender disparity is alarming, especially as STEM careers are often referred to as the jobs of the future, driving innovation, social wellbeing, inclusive growth and sustainable development. Although girls generally perform better than boys in the Programme for International Student Assessment (PISA) and International Computer and Information Literacy Study (ICILS) international skills tests, they veer away from STEM subjects with age. Actions to promote high quality and inclusive computing education can impact positively on the number of girls pursuing IT-related studies in higher education and, further on, working in the digital sector or digital jobs in other economic sectors. Efforts to address gender stereotypes and gender bias in the digital sector are crucial to improving gender balance in the sector.

4. EU STEM approaches

At the European Union level according to the She Figures 2021, women are still underrepresented as doctoral graduates in STEM fields, including physical sciences (38%), ICT (20.8%), engineering (27%), and mathematics (32.5%) [2]. In order to fix the situation one of the six priorities of the European Commission envisages the digital transformation of Europe by 2030. The Strategy “A Europe fit for digital age” evolves around four cardinal points: Basic digital skills for min 80% of population; Digital transformation of businesses; Digital infrastructures**;** Digitalization of public services (key public services - 100% online).

„Digitization is massively increasing the demand for ICT specialists in the labor market. But that alone is not enough: we will also need to boost basic skills amongst the work force and population at large. Digital literacy has to be a foundation for everyone" [3]. One of the 14 actions of the Digital Education Action Plan 2021-2027, Resetting education and training for the digital age, provides "Encourage women's participation in STEM, in cooperation with the European Institute of Innovation and Technology (EIT); support the EU STEM Coalition to develop new higher education curricula for engineering and information and communications technology based on the STEAM approach to be more attractive for women and increase their participation and career development in STEM subjects and IT" [4]. Another instrument of the European Commission to improve the situation in the field of STEM is the Program dedicated to research and innovation - Horizon Europe. Projects are expected to contribute to increasing cooperation between relevant research and innovation actors from academia, the private sector and national administrations to encourage the participation of women and girls in STEM studies and careers through a STEAM approach. The most recent calls, launched on December 6, 2022, for approaches to gender-responsive STEAM education are: Support to the implementation of an EU Manifesto for STE(A)M education and research and innovation career paths to tackle gender inequalities in ERA; Cultural and creative approaches for gender-responsive STEAM education; Organization of the Women TechEU Scheme [5].

5. STEM education in Moldova

In the case of the Republic of Moldova, the problem of integrating women and girls in STEM sciences is even more accentuated. Although according to National Bureau of Statistic data almost 60% of higher education graduates are women, only 20.5% of them are employed in the STEM field [6]. The perception that the so-called core technological careers are more demanding in terms of availability due to high responsibilities prevails. As long as decision-makers are predominantly male, it will be difficult for women to find a role model in the STEM world. According to the Global data on National Parliaments on January 1, 2023 Moldova is situated on 27th place out of 190 countries with 41 seats occupied by women out of 101 seats in parliament [7]. The participation of women in decision-making in the Parliament reveals a representation of women in a proportion of 38.6% compared to 31.0% at the European level and 26.5% at the global level. However, despite the fact that at the European and Global level the situation from the perspective of the gender dimension in Moldova is quite good, stakeholders in collaboration with policymakers can and must continuously contribute to improving data collection, monitoring, and evaluation of policies aimed at tackling inequalities in STEM fields to better understand which programs are most effective and efficient. The issue of gender disparities in STEM is a complex one and should be addressed accordingly. Considering the underlying causes of gender disparities in the sector and integrating them into policies is vital, as treating the symptoms without addressing the causes would lead to superficial and ineffective measures. To promote and encourage the emancipation of women, the government must be well informed about how the research system of the Republic of Moldova works in practice, the barriers to access and how the challenges can be overcome. One of the major problems in attracting women to STEM is the unattractiveness of the research system of the Republic of Moldova. According to the Eurostat data base "European Neighborhood Policy ranking", the Republic of Moldova records the lowest results regarding the attractiveness of the research system with the lowest level of funding (0.2% GDP) and the lowest number of researchers per capita, - 4 times less researchers than the European average [8].

Table 1. Cross domestic expenditure on research and development for the years 2010 and 2020

	Cross expenditure on R&D (€ million)		R&D expenditure (€ per inhabitant)		R&D intensity (% of GDP)	
	2010	2020	2010	2020	2010	2020
EU	216261.1	310711.1	490.8	694.6	2.0	2.3
Armenia	16.8	*	5.2	*	0.2	*
Azerbaijan	87.3	82.7	9.7	8.2	0.2	0.2
Belarus	288.8	290.7	30.5	30.9	0.7	0.5
Georgia	25.4	*	5.7	*	0.3	*
Moldova	19.3	23.8	5.4	6.7	0.4	0.2
Ukraine	854.1	552.9	18.7	13.2	0.8	0.4

* Lack of data on the Eurostat portal

However, it should to be mentioned that, starting from the increasingly pronounced role of STEM in the national economy and the importance of ensuring equal opportunities and empowering women and girls in this sector, and in order to ensure a social and economic balance in Moldavian society, some measures were taken. An eloquent example of success is the creation in 2017 of the Center of Excellence - Tekwill. Tekwill has been designed as a national public private partnership between the Government of Moldova, USAID, Microsoft, and IBM to answer the needs of the ICT industry to close the gap of the human capital shortage, as well as support the development of the entrepreneurship ecosystem. In a very short time Tekwill has become the home of innovation, where people are connected with ideas, resources, science and industry to enhance IT excellence. Being considered as one of the biggest public private partnerships, the key success of the project is to ensure the proper involvement of all stakeholders into the process. Since its establishment more than 718,232 people have participated in Tekwill activities, of which 44.48% are women. More than 1,597 teams and products were developed through projects [10]. Among the priorities of the Tekwill project is to introduce more women into the workforce in the ICT sector, as well as to reduce income and occupational imbalances. Thus, three years ago, the Tech Women empowerment initiative was born. Tech Women hub brings together a multitude of events for experience exchange, knowledge transfer, mentoring programs, motivational conferences, educational actions and to facilitate access to career opportunities, growth and professional affirmation in the field of technologies. It provides guidance and links to information and resources that can be used to spark girls' interest in STEM and raise awareness of the importance of girls' engagement in these fields of today and tomorrow. Due to a prodigious collaboration between Tekwill, the UN Women over 1000 girls and women have been trained in the IT field. This is one of the successful examples denoting a positive evolution in creating good premises and conditions for improving the situation of attracting women in STEM education. At the same time, it is worth noting the importance of other organizations that promote STEM fields among girls in the Republic of Moldova, such as: Girls Go IT, Tech Ambassadors, Rails Girls, ICT Career Orientation and ATIC.

5. Conclusions

In conclusion, it can be said that in the present, social, cultural, economic, educational and institutional factors sustain the persisting gender segregation across study fields. Stereotyping in education, gender differences in educational and training choices and a lack of female role models are major problems contributing to the low percentage of women graduating in STEM subjects. The growing demand for professionals with skills in science, technology, engineering and mathematics (STEM) and the so-called fourth industrial revolution is expected to create a wide range of new jobs in these fields. However, unless efforts are made to address the mismatch between current skills and what will be needed for the future, this revolution will leave behind a large proportion of girls and women who are underrepresented in these fields.

However, there are solutions that can turn things around. A basic recommendation is to combat stereotypes by simply convincing individuals that they exist and should be avoided. Also, promoting successful models is a good method of encouragement. The power of example boosts motivation, causing women to believe in their capabilities and that they can achieve success that others have found impossible to achieve. Facilitating access to mentors is also essential, ensuring young women's interest in a STEM career is maintained.

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