STEM IT LIKE A GIRL

MACEDONIA 2025
Helping Build a Stronger Nation

FOUNDATION ANA AND VLADE DIVAC

CFLI/FCIL
Canada Fund for Local Initiatives
Fonds canadien d'initiatives locales

Canada

SCIENCE • TECHNOLOGY • ENGINEERING • MATHEMATICS

"Is STEM the right choice for me?" -

The role of education in empowering girls to choose a STEM career

October 2022

The main aim of the "STEM≡quality" program is to promote careers in the STEM field with a focus on young girls/women. Through a public campaign and lectures of successful women with STEM careers, the intent was to stimulate and encourage young girls to choose STEM education and/or career. That will enhance career opportunities for young women, reduce gender inequalities, and will increase women's empowerment. The project was implemented on the territory of two neighboring countries, North Macedonia and Serbia. The proposed initiative will contribute to improving the environment in North Macedonia and Serbia for sustainable socio-economic development and greater use of the potential of young women.

Promoting gender equality and closing the gender gap is of paramount importance. This policy brief presents the results of a study related to a project aimed at stimulating STEM career choices among primary school female students through the presentation of successful role models. The study accompanying the intervention showed the importance of: (a) early interventions in raising the attractiveness of STEM careers as the young girls put their interests and desires as one of the most important factors when choosing a career; (b) the role of the educational system not only in developing knowledge and skills but also self-confidence to pursue a STEM career; (c) creating a support system for young girls to nurture their interest in STEM. Interventions to reduce the gender gap in STEM should be multifocal and include changes in formal education in terms of curricular changes to promote the role of women in STEM, build more skills and enhance the confidence related to possessing skills and creating a better support system of career counseling and support.

The importance of STEM and factors related to choosing a STEM career

STEM education is a broad concept encompassing teaching and learning in the fields of science, technology, engineering and mathematics across all levels of education. Stimulating more students to choose STEM careers has economic benefits in terms of preparedness of the country to face downturns (Williams, 2011) and GDP growth (Donovan, 2014; Hanushek et al., 2018) as well as personal benefits in terms of better earnings (Beede et al., 2011). However, there is still a gender gap in the field. Namely, the share of women in STEM is still lower than the share of men worldwide (UNESCO, 2019). As such it is of paramount importance to stimulate more girls to choose STEM subjects and STEM careers and to support women who choose a STEM career. The interventions should start in primary school as that is the age when children start considering different occupations and start developing career aspirations (Magnuson and Starr, 2000; Almeda and Beker, 2020). Females, in general, show lower perceptions of the value of STEM careers, less interest and less positive perceptions of STEM professionals than males which are all related to the influence of their social environment (Mason and Rich, 2020). Many interventions have shown that different types of stimulating activities can enhance interest in STEM careers and female role models were shown to be useful in stimulating STEM interest among women (Mishkin et al., 2016). Therefore, understanding the factors related to STEM career interest as well as successfulness in stimulating such interest among primary school female students using role models is the center of interest of this policy brief.

Methodology

The data was collected as part of the "STEM≡quality" project that was implemented in North Macedonia and Serbia with primary school students. The effects of the program were measured through a comparison of the participants' opinions, views and experiences before the intervention and after the intervention. The intervention in this research is actually a lecture in the form of motivational speech and sharing personal experiences of women (from the respective country and the diaspora) who have successful STEM careers. The participants filled out a questionnaire before and after attending the lectures.

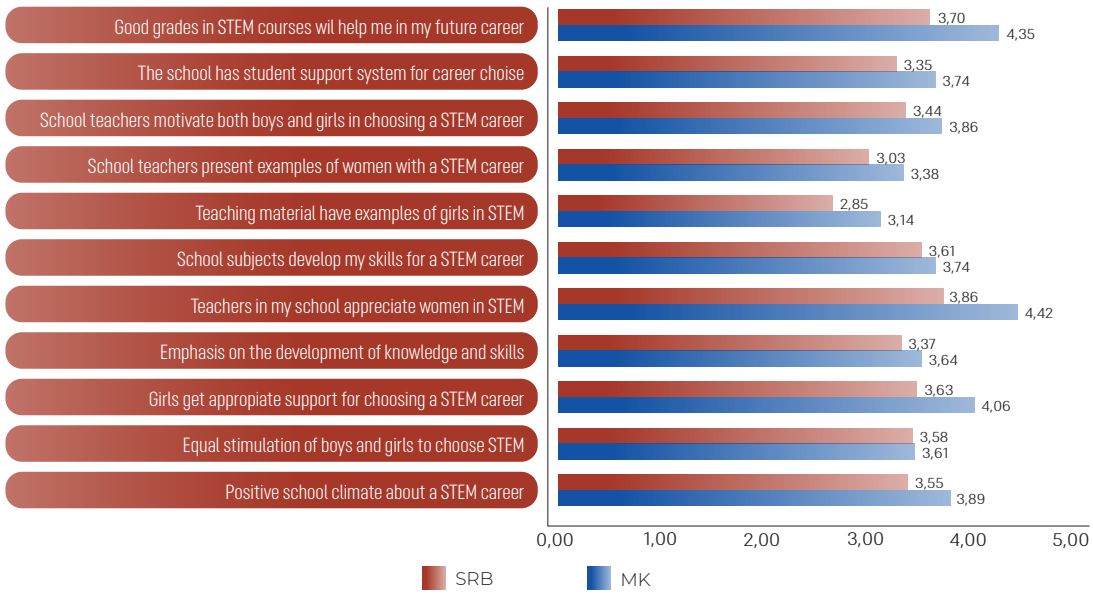
The sample in North Macedonia consisted of 308 respondents from 10 primary schools with an average age of 14. The sample in Serbia encompassed 252 respondents from 10 primary schools in Serbia with an average age of 13.

The career choice of girls – comparison before and after the intervention

The data indicates that the girls seriously consider a career in STEM. In Macedonia, 46% of the respondents stated that they would choose a career in STEM, which increased to 52.6% after the intervention. In Serbia, 38.1% stated that they would choose a career in STEM prior to the intervention and that percentage rose to 48.4% after the intervention. This shift in the positive direction **provides some evidence for the effectiveness of the use of motivational speeches** and sharing personal experiences, and indicates that motivational speeches have the potential to stimulate interest and intentions in choosing a STEM career.

What is interesting to note is that the **students generally believe that the school does not stimulate them to pursue a STEM career** (Figure 1), although the findings point to a slightly better perception in Macedonia than in Serbia. Students are generally positive about the level of appreciation of women in STEM by the teaching staff (best assessment) and having good grades from STEM subjects as a driver toward success in their future careers. On the other hand, students' assessments tend to be slightly negative when it comes to the examples of women in STEM that can be obtained during education with the lowest assessment being given to the examples in the textbooks and teaching materials for women with STEM careers, and the second weakest assessment is the role of teachers in giving examples of women with STEM careers.

Figure 1. Student's appraisal of the role of the educational system in stimulating STEM career choice



Source: Field research of Macedonia2025 and Field research of Ana and Vlade Divac foundation

Students in both countries strongly agree that STEM careers are equally appropriate for women and men, that women are equally successful as men in STEM professions and there is appreciation of their families of women with STEM careers. A **positive shift** in all these factors was achieved **after the lecture**. Students in Macedonia least agree that women with STEM careers in their country are appreciated a lot. Before the lecture students had mostly neutral responses to statements that they personally know women with STEM careers. Expectedly, after the intervention, there is a positive shift in terms of how many women with STEM careers they know. These findings **support the need for various informal interventions of presenting a more positive picture of the role of women with a STEM** career in society, as well as the support that women can receive in building a STEM career.

To understand the determination of the participants in choosing a STEM career, the factors that can play a role as well as the potential of interventions including role models in stimulating a STEM career choice a series of questions were asked related to: the intention to build a STEM career, the attitude toward a STEM career, the perceived internal control (the opportunity for success in the given career) and social norms (support from the closest environment, namely parents, teachers and friends). Students' considerations in all of the categories in both countries shift in a positive direction towards STEM fields after the lectures (Figure 3). Given the small scale of the intervention (only one lecture), it can be expected that the effect would be much higher in the case of continuous exposure of young girls to role models. **After the lectures, the intentions of the students to choose a STEM career became more positive**, i.e. the students show greater commitment to choosing a STEM career. As for the factors related to the intentions, students **most positively assessed the social norms**, i.e. the perceived support from the closest environment (parents, teachers, and friends). After the lectures, the level of perceived support increased. Students have a **slightly positive attitude towards a STEM career** (assessment of the positive aspects of building a STEM career) which also shifts positively after the intervention. This means that students assess the satisfaction and attractiveness of a STEM career more positively after the lectures. Out of the four factors, **students gave the relatively low self-assessment to the perceived internal control**. In other words**,** girls show suspicion that they possess the abilities and skills perceived as necessary for success in STEM careers. Although this assessment also **improves after the intervention**, it is the weakest one, which means that in the future efforts should be linked to building positive attitudes toward STEM, as well as increasing students' self-esteem and perception of success in STEM.

Figure 2. "Considerations in relation to building a STEM career – before and after the intervention" (average values)

Source: Field research of Macedonia2025 and Field research of Ana and Vlade Divac foundation

The students **generally enjoyed the lectures** and gave quite a positive appraisal of them with over 70% of them in both countries stating that they are completely agreeing or agreeing that the lectures were interesting, enjoyable, full of useful information, and made them think about STEM. The positive impressions of the girls related to the lectures that they attended were visible in their comments to the open-ended question in the second questionnaire. For some, the lecture was an eye-opening experience that clarified many issues about what STEM actually entails:

This lecture opened new horizons for me. So far I perceived STEM quite differently. I feel motivated to do whatever I want (Macedonia)

Many of the girls started perceiving STEM careers in a more positive light and the lecture offered them instigation to start considering STEM as their career choice or not giving up on their dreams to pursue STEM careers:

The lecture was great. In the future, I want to pursue a STEM career, but I didn't think I could because it's more of a job for boys. I was surprised by the support provided, that I can do STEM as well when I grow up (Serbia)

Most importantly, the lectures were not only found to be inspiring and motivating; but were also seen as something that built their self-confidence:

At first, I thought it would just be a lecture about choosing STEM, but then I was surprised by the level of self-confidence they instigated. I learned that I should never give up on my dreams. (Macedonia)

Recommendations

The main general recommendation is that the education systems should play proactive roles in stimulating the development of necessary STEM skills, enhancing motivation to choose STEM careers, and providing bigger support for girls to choose STEM careers.

On the state level, the study has developed the following recommendations:

- Enhance the school curriculum with a broad range of subjects and support activities that can stimulate the development of skills and interest in STEM;
- Provide a more balanced representation of male and female STEM role models in the teaching and learning materials (textbooks, support materials, digital resources);
- Enhance the preparedness of teachers to enhance the development of skills and interest in STEM;
- Develop a network of STEM role models – including cooperation between community, businesses, parents, and schools – as a support system for young girls that would like to pursue a STEM career;
- Develop a comprehensive system of support for those who choose a STEM career like scholarships, mentoring support, internships, etc. with a particular focus on girls and clearly communicate it;
- Develop longer-lasting interventions for developing motivation and interest in STEM among girls.

On the school level:

- Create a school climate that will be conducive to stimulating all students to choose a STEM career regardless of gender and socio-economic background;
- Utilize the teaching and learning processes within the classroom to develop STEM skills and build confidence related to STEM equally among boys and girls;
- Use extracurricular activities (like motivational speeches, school visits, and workshops) to stimulate all students equally to choose a STEM career, by providing positive examples of women in STEM;
- Strengthen the role of career counselors and career centers in schools so that students, especially female students, can receive adequate career choice support.

This project is supported by the Embassy of Canada through Canada Fund for Local Initiatives.

The views, findings, and conclusions or recommendations resulting from this project do not necessarily reflect those of funding partners or their respective governments.