

Bridging STEM, Sustainability, and Peacebuilding: Youth@STEM4SF from Swiss high school pilot towards Balkans

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In response to declining student interest in physics and STEM fields, particularly among girls, the pioneering initiative Youth@STEM4SF (Youth at STEM for Sustainable Future) [1,2,3] developed with the international multidisciplinary community, was launched as Swiss pilot in 2023 under the auspices of the UNESCO International Year of Basic Sciences for Sustainable Development. Developed in partnership with the Swiss Physical Society (SPS), and Swiss educational authorities, Big Science Business community and other important partners, this innovative program introduces high school students to physics and STEM subjects through real-life applications, sustainability challenges, and encounters with inspiring role models from academia and industry.

During 2023-2024 the program has been successfully implemented in several Swiss schools reaching over 200 students from diverse schools and more than 100 Slovenian and Italian students through the pre-event of Big Science Business Forum in Trieste in 2024. It connects physics to pressing societal needs, such as climate change, energy, medical technologies, and environmental protection, by offering thematic days that include interactive talks and visits to tech industries and actors of innovation ecosystem; scaled up by student competition on the co-creation of new education materials connecting natural sciences with sustainable development. The most promising ideas from students are co-developed into digital teaching resources aligned with official education strategies. A majority of participating students, especially girls, reported a significantly increased interest in STEM fields, citing the visibility of relatable role models and societal relevance as key motivational factors.

This paper presents the outcomes of the Swiss pilot as a proof of concept and outlines a vision to expand the program to the Balkans during the UNESCO International Decade of Science for Sustainable Development (2024-2033) [4]. The project's methodology –context based STEM teaching, connection to sustainable development and major societal challenges, modular thematic days, co-creation of teaching materials with target audience (students and teachers), digital user-friendly resources creation, teacher empowerment, multistakeholder collaboration and dive into the real innovation ecosystem (research and industry), gender equality in real action, capacity building for informed careers' decisions - offers a scalable and adaptable model. Its application in the Balkan context seeks not only to raise STEM interest and appreciation, but also to promote regional peacebuilding, inspired by CERN's model of international scientific collaboration and initiatives like SEEIIST [5], which is extremely relevant specifically in Balkan post-war countries. Therefore, the paper will discuss the program's potential for cross-border engagement and science diplomacy.

By fostering a network of engaged students, teachers, scientists, and policymakers, Youth@STEM4SF aims to reform how STEM is taught and perceived. It strengthens links between science education and sustainable innovation ecosystems, helping to mitigate brain drain and build a new generation of informed, empowered leaders. This paper explores how this Swiss-born initiative can be adapted to support education reform, scientific literacy, and peace through science in the Balkan region and beyond, following the success of pioneering STEM education trends already successfully piloted in Switzerland, Slovenia and Italy.

[1] B. Bruant Gulejova, Shaping high school science education with tech industry in action for sustainable development, *Communications de la Société Suisse de Physique* 73, 61 (2024); https://www.sps.ch/articles/various_articles/

[2] Youth@STEM4SF (Youth at STEM for Sustainable Future) project, 2024 video: <https://www.youtube.com/watch?v=uCvYcsR8qkE;>

[3] B. Bruant Gulejova, Role of research and industry to attract future workforce, *Europhysics News* 56/2, May 2024, <https://epn.eps.org/epn-56-2/#14>

[4] UNESCO International Decade of Sciences for Sustainable Development (2024-2033), www.un-sciences-decade.org

[5] SEEIIST –The South East European International Institute for Sustainable Technologies, <https://seeiist.eu/>

Primary author: BRUANT GULEJOVA, Barbora

Co-authors: Dr VOURLIAS, Konstantinos (Aristotle University of Thessaloniki); Dr DAMJANOVIC, Sanja (GSI, Germany)

Presenter: BRUANT GULEJOVA, Barbora

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