

# Active In-Service Training on Transversal Skills: Two Pilot Cases in STEM Disciplinary Teaching

Vera MONTALBANO (1), Daniela MARCHINI (2)

(1) *Department of Physical Sciences, Earth and Environment, University of Siena, via Roma 56, 53100, Siena, Italy*

(2) *Department of Life Sciences, University of Siena, via Aldo Moro, 2, 53100, Siena, Italy*

**Abstract.** Promoting gender equality in STEM disciplinary teaching and self-assessment skills in students requires transversal competences and methodologies that are usually not included in teachers' cultural background. Based on previous experiences, we implemented, in an interdisciplinary team, two in-service training courses for teachers. In one, after introducing the topic of gender and related educational issues, teachers were invited to develop a learning path to be implemented in class in the following months. Then we analysed together the results and critical issues that emerged. In the other, a laboratory of self-assessment for students is promoted by an in-service course for STEM teachers

## Introduction

Transversal competences' learning, while being critical to future professional success, is not an easy or straightforward process [1]. It involves various stakeholders, with a particular focus on students and teachers. It should be explained and participatory, including formal learning, but also non-formal and informal learning, in an integral logic of acquiring and developing competences.

Two pilot experiences were conducted to address issues that have emerged in recent years in our territories, specifically southern Tuscany. These issues include a decrease in the number of girls interested in physics studies and a decline in scientific skills among students entering scientific degree courses.

## Active In-Service Training for promoting gender parity in STEM

Despite being one of the Sustainable Development Goals, achieving gender equality and empowering all women and girls by 2030 is not on track [2]. The underrepresentation of women in science, technology, engineering, and mathematics (STEM) fields is a well-documented issue in developed countries. However, current actions to overcome gender disparities in STEM are far from satisfactory. Courses in biology or mathematics often have a predominantly female gender distribution, which presents the opposite issue. This phenomenon is influenced by pre-existing biases and reinforced by experiences in high school.

Improving transversal professional skills is crucial for science teachers to identify their own and their students' biases, the mechanisms that reinforce them, and the positive actions in disciplinary teaching practice that can weaken them through positive experiences in the scientific field.

The development of an in-service training course for teachers last year was a successful project in this direction. The provincial school office, in collaboration with the University of Siena and the University for Foreigners of Siena, organized the course for teachers from every school level in the province of Siena. The course was divided into two parts, with the first one focusing on addressing issues related to inclusion. It provided active tools [3] for recognizing prejudice and discrimination to all teachers. In the second part, teachers followed separate modules in homogeneous groups based on school level and disciplinary macro areas. The module aimed at high school teachers in the STEM area was expertly coordinated by one of the authors (VM), who

involved the other author in some activities. As a result of the participants' requests, it was decided to continue with a course for high school teachers. The results of the latest course, which had 20 participants, are presented. The course included activities that were concentrated at the beginning of the school year and lasted for 16 hours. Each participant then designed and implemented a learning path in the following months, taking into account gender discrimination in disciplinary activities. A focus group will discuss the experiences gained by the end of the school year.

### **Self-evaluation laboratory in STEM: a pilot case**

Prior knowledge is essential for success in STEM courses at university and is usually tested in entrance exams. One of the actions of the National Plan for Scientific Degrees is dedicated to improving these initial skills.

In 2020, the PLS-Biology, PLS-Chemistry, and PLS-Natural and Environmental Sciences promoted an activity aimed at improving the scientific skills necessary to pass the respective tests. The interdisciplinary group of the Sienese PLS proposed a self-evaluation laboratory for the high schools of southern Tuscany, which included all the scientific disciplines involved in university entrance tests.

The laboratory is designed for STEM teachers who can enrol one or more classes, preferably in the third or fourth year of the high school course). The first step is an entrance test provided to teachers, who will decide which disciplines and topics can be addressed by their students, administered in the same ways and times as those foreseen by the tests administered in Italy almost exclusively through a portal online managed by an inter-university consortium (CISIA). Teachers correct the tests and identify critical issues in the teaching of certain disciplinary topics in the results. Addressing these critical issues through a short course dedicated to professional development allows teachers to plan and implement educational interventions aimed at overcoming them. The effectiveness of the intervention will be evaluated based on the results obtained by the students in one of the tests on the OrientAzione portal [4] (an online resource was developed in the PLS to support these actions).

There are 8 schools registered in the laboratory, with 25 classes followed by 36 teachers, 18 science teachers, and 18 mathematics and physics teachers.

We present the materials provided to the participants as examples of possible teaching tools to be used in the classroom and the critical analysis of the results obtained after the teachers' elaboration and implementation in their teaching context.

### **References**

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