

Breaking down classroom walls to STEMulate collaboration in science and mathematics education

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Goal of the communication and connection to one of the MACAS topics

There is a critical need for STEM education in schools. Yet teachers seem ill-equipped to do so, which suggests that part of the problem lies in pre-service education. We are therefore interested in critical issues in STEM education, which in turn leads us to ask curricular questions about how to integrate math and science in post-secondary education through a STEM perspective. Thus, the goal of this communication is to initiate a reflection on the place of STEM education in pre-service teacher training.

Proposal

In recent years, we have witnessed (or participated in) a movement aimed at developing students who are able to mobilize a range of knowledge, skills, and attitudes to better understand, analyze and attempt to solve various problems around them, as well as actively participate in society by initiating or participating in innovative projects. In many cases, students need to make connections between science, technology, engineering, and mathematics (STEM) to find solutions to these problems (Bakırcı and Karışan, 2018; Bergsten and Frejd, 2019; Maass et al., 2019). This has led to the need to improve STEM education in schools. Yet, some people would agree that our current educational system does not really support STEM education (Gravemeijer et al., 2017). We suggest that the problem lies in the pre-service training of teachers, who feel ill-equipped to create learning-rich environments and support students in their STEM learning in those environments. While STEM education in schools is well documented, the situation is different for STEM education in the university setting. While there are some university courses that address STEM, few if any initiatives leverage STEM education collaboratively across different courses. What type of pre-service training adequately educates future teachers in STEM education? What skills and abilities must they develop to be able to accompany students in their STEM learning?

During the fall 2020 semester, the mathematics education course as well as the science education course had the same schedule. That simple detail led to a collaboration between both professors of these courses. We co-taught part of the mathematics education and science education courses and engaged students in a collaborative STEM experiential learning project. They visited an organic farm, transferred their new knowledge to a classroom context (STEM didactic situation), and discussed this situation with two high school teachers (math and science) in an environment drawing on professional learning communities. What began as a pedagogical project is now being transformed into a research project, in which we focus both STEM didactic-pedagogical training offered in pre-service education and in STEM learning of students in mathematics and science didactics courses. More specifically, we aim to:

- understand how to integrate STEM education into mathematics education courses and science education courses through experiential learning and faculty collaboration;

- synthesize the higher order skills and abilities developed by students enrolled in mathematics and science didactics courses as they develop STEM teaching situations.

During this communication, we will share our experience, as well as the results of interviews with some students enrolled in either of the didactics courses. For our part, we noticed that people are particularly engaged when working on this type of project, sometimes exceeding our expectations. We recognize the strong pedagogical potential of this initiative, as we believe that it enriches teacher training to better prepare teachers for the 21st century while promoting the aims of the Ministry of education. Regarding students, while some were completely unsettled at the beginning of the semester, over time they came to understand the purpose of the activities better. While math and science are often isolated in school, they particularly appreciated the connections they were able to make between math, science, and real-life situations, even if it was not always easy. What is left for them after this experience? The realization that STEM education requires a lot of time and commitment, but also an openness to let go, to give more space to the students and to try new things.

References

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