

# A training concept for supervising self-directed problem-solving in the STEM disciplines

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*How can school and university tutors support pupils and students in self-directed exploration and open-ended problem-solving? What are helpful didactic methods and pedagogical approaches, and how can teachers and tutors learn which approach they should use? In our poster we first define what we mean by open-ended problem-solving, using an example problem as illustration. We then detail some of the issues that can be encountered by tutors during the supervision of such problem-solving and outline our proposed method for addressing these issues.*

*Keywords: Mathematical modelling, problem-solving, research tutors, workshop concept.*

## WHY MODELLING?

Undertaking mathematical modelling tasks, in the form of mini research projects, has been shown to be highly educationally beneficial. Our understanding of a mathematical modelling project is one:

1. where there is no fixed method for obtaining a solution, so that it can be approached by students with different levels of mathematical knowledge and ability; and
2. that is open-ended.

Engaging in applied mathematical exercises promotes the development of skills similar to those used in research, such as self-directed study, problem-solving and explorative ways of thinking (Bracke & Humenberger, 2012; Greefrath et al., 2013). In our case we wish to focus on cases where the problem being set has a relationship one or more of the other STEM (science, technology, engineering and mathematics) disciplines, thereby strengthening both the mathematical understanding of the student as well as their competence in the related fields.

Mathematical modelling is a goal-oriented process, and the success of the activity depends, in part, on whether the predefined goals given by a (fictive) client are achieved or not. In our case the client is the problem setter, in most cases the school teacher or university tutor supervising the project.

## **ROLE AND RESPONSIBILITIES OF THE MODELLING TUTOR**

To date there is no scientific evidence regarding didactics and methods for appropriate advanced training of both research tutors and problem-solving tutors (Kunter et al., 2011; Link, 2011). Our training concept is based on the fundamental assumption that the effectiveness of a tutor depends on his or her attitude towards the learners and students as subjects of their learning. The idea is for the tutor to have confidence in the learners' strengths and potentials; to believe in the inherent resources and strengths of the students' as well as their ability to independently find appropriate help in their environment. The role of the tutors is not only to support the learners on the subject-related objective level but also to perceive and understand the attempts the students make and the steps they take to find solutions.

Our training concept leads the tutor through three separate roles they play over the course of a modelling project:

- in the role of the (fictive) client;
- as a specialist in his or her subject field; and
- as an empathetic and understanding listener.

Through playing these three separate roles we believe that the tutor can support the student with the subject-specific contents and at the emotional and motivational level, while also helping them to find a good strategy and progress with their problem.

We strongly believe that our innovative training concept will give school teachers and university tutors the theoretical background with which to successfully supervise modelling projects and inquiry based learning processes in the STEM subjects.

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