

Teaching and assessing mathematical competencies and understanding

As pointed out by the ICMI Study “Educational Interfaces between Mathematics and Industry” we need to “emphasize and organize (...) formation and training on mathematical modelling” because “mathematical modelling plays a crucial role” to connect mathematics and its applications outside mathematics (New ICMI Study Series, vol. 16, p. 441).

As many authors from different areas concluded, “Mathematical competence is the ability to understand, judge, do and use mathematical concepts in relevant contexts and situations, which certainly is the predominant goal of the mathematical education for engineers.” (A Framework for Mathematics Curricula in Engineering Education, A Report of the Mathematics Working Group, European Society for Engineering Education (SEFI), 2013). This same report points out that “Modelling mathematically (...) is definitely the one which is covered to a large extent in application subjects. There, modelling principles are developed and used to set up real models where finding an adequate modelling granularity is a major issue. Students also have to interpret the results of working within the mathematical models from an application perspective and have to validate the models, e.g. by making experiments and taking measurements”.

It is clear that mathematical modelling is a key mathematical competency we need to introduce in the curriculum at all levels.

There are however challenges to implement mathematical modelling in the curricula in secondary schools or higher education. We will review some of these challenges and make some proposals to teach and assess it effectively, namely:

- developing mathematical modelling modules that contextualize educationally concrete contexts and can be used in the classroom;
- implementing mathematical competitions based on mathematical modelling activities (that, unlike other contests, can take several days to complete);
- develop small mathematical modelling projects to be presented in mini symposia (like the so called “Mock symposia”) and credited for assessment.