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# Editorial: Mathematical modelling through and with digital resources

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Editorial on the Research Topic
Mathematical modelling through and with digital resources

Digital resources have become increasingly important in mathematical modeling in mathematics education. Their development has rapidly intensified due to technological advances (Siller et al., 2023). This Research Topic is dedicated to the use of digital resources in the context of modeling processes in mathematics education. It aims to answer the question of the extent to which empirical findings on mathematical modeling with technology are available in specific settings. To this end, both students and prospective teachers as well teachers teaching mathematics are considered in this Research Topic.

Studies on teachers for mathematical modeling with technology address especially possibilities in teacher training. The use of technology in the classroom requires additional professional competencies for teachers, as demonstrated by the greater potential available through technology alone and the discussion of modeling cycles with technology (Greefrath et al., 2018).

Brady presents a pedagogical approach to integrate mathematical modeling into geometry for pre-service mathematics teachers to formulate and explore geometric conjectures. The qualitative results demonstrate how students employ modeling and gestures to comprehend geometric phenomena, establish connections to prior investigations, and formulate and prove mathematical conjectures.

Gerber et al. concentrate on simulations and mathematical modeling with digital resources. The article highlights the importance of teachers possessing adaptive intervention competence when teaching simulations and mathematical modeling with digital resources. It presents a domain-specific process model, distinguishes various types of teacher interventions, and describes the content of a university course aimed at promoting this adaptive intervention competence. The study confirms a two-dimensional model of cognitive dispositions related to this competence and quantitatively verifies the effectiveness of the course. The results are discussed, and conclusions are drawn regarding the promotion of this professional competence in university courses.

Andresen examines the role of digital resources for teachers in learning differential equation systems through modeling. The article discusses whether pre-made digital resources, such as simulations of differential equation system models, expedite the teachers' learning process and hinder the learning of mathematics. The term "modeling direction" is used to differentiate between expressive and explorative modeling. The study demonstrates the importance of diversity in the relationship between resource use and mathematics learning when designing modeling sequences, particularly for differential equation systems that rely on digital resources.

The studies focussing on students deal with reality-based problems using digital resources. While technology-based approaches offer new opportunities for modeling education, they also present challenges. A literature review by Cevikbas et al. (2023) shows benefits of digital technologies.

This is in line with Jablonski et al.'s research, which investigated the use of digital resources to assist in solution validation for modeling tasks. The study involved secondary school students who were divided into two groups: one group used the MathCityMap app, while the other group did not receive any digital support. The findings expose clear usage patterns of app features for feedback, emphasizing the importance of solution validation and corrective app feedback through qualitative analysis. The study suggests that the MathCityMap app is useful for mathematical modeling tasks, especially when validating the solution.

In this study, Cohen-Nissan and Kohen examine the competencies and motivation of 770 ninth-grade secondary school students while engaging in mathematical modeling tasks within a virtual learning environment during a 5-day online summer camp. The assessment of student competencies in mathematical modeling utilizes Padlet modeling tasks and observations. Questionnaires on motivation are administered before and after the activity. The current results show that students have varying levels of competence in mathematical modeling, as well as moderate to high levels of proficiency in solving mathematical questions within the model and interpreting the results. At present, students are improving their self-concept of ability, expectations of task difficulty, and attitudes and interests in modeling tasks. The current learning environment includes structured activities and learning materials, supported by guidance and cooperative learning, which promote student competencies and motivation to participate in mathematical modeling.

According to Krause et al., digital resources are increasingly used in modern maths lessons, and students often require suitable mobile devices to access them. There are various concepts for how students can gain access to these devices. For instance, students may use their own devices (known as the BYOD concept) or the school may provide devices (known as the pool concept). This study examines the impact of these concepts on students' mathematical modeling competencies. The results indicate that the effects vary depending on the access concept and problematic smartphone use. The study highlights the significance of carefully choosing the access concept while considering the characteristics of the students.

The studies presented in this Research Topic provide examples of how digital resources can be effectively integrated into the modeling activities of both students and teachers.

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