

# Enhancement of research excellence in Mathematics Teacher Knowledge: collaborative designing of lessons and learning progressions

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## Introduction

The title of this poster is a name of a Horizon 2020 project with the acronym MaTeK. The project belongs to the Twinning action, which stands for research infrastructure building and institutional networking. The general goal of MaTeK project is to strengthen the research performance and develop the excellence of the Department of Mathematics Education (DME) at the Faculty of Mathematics, Physics and Informatics of Comenius University in Bratislava, Slovakia (UK BA), in the field of mathematics teacher knowledge enhancement. Teacher knowledge is the prerequisite of the education enterprise, and student knowledge development its objective. For researchers, it is essential to understand what kinds of knowledge mathematics teachers develop, and how they use their expertise in teaching in order to help students to develop deep knowledge in mathematics. One of the ways how to address this issue is to work with pre-service mathematics teachers on lesson and learning progression design capacity (Pepin et al., 2017). The specific goal of MaTeK is to provide the DME with opportunities to work with and learn from partners and exchange best practices in the field of mathematics lesson and learning progression design, with focus on the topic of reasoning and proof (R&P). R&P is an important strand of mathematical proficiency (e.g., Kilpatrick et al., 2001), and research has shown that pre-service teachers are often not adequately prepared to cultivate opportunities for students to engage with reasoning and proof (e.g., Stylianides & Stylianides, 2009).

MaTeK is twinning the departments of Mathematics Education of five European universities: 1) Comenius University in Bratislava, Slovakia (UK BA), coordinating/applicant institution; 2) Charles University, Prague, Czech Republic (CU); 3) University of Palermo, Italy (UNIPA); 4) Norwegian University of Science and Technology, Trondheim, Norway (NTNU); and 5) Middle East Technical University, Ankara, Turkey (METU).

## Research plan and activities

The general goal of MaTeK will be achieved through a series of twinning schemes, including workshops, seminars, summer schools, staff exchanges, and conference attendance, that will all be closely related to a well-defined common research study, with the following research question: *How can pre-service teachers' design capacity in terms of reasoning and proof be enhanced?*

The project has started in January 2021 and, within its duration (until December 2023), will follow a Design Research approach (McKenney & Reeves 2019), with the following three research phases: 1) Exploratory study (context and needs analysis); 2) Lesson and Learning Progression design & Intervention; and 3) Enactment & re-design. Our main target group in phases 2 and 3 is pre-service mathematics teachers for grades 5-10 at each MaTeK institutions. Their understanding of the mathematical learning progressions and lesson plans design involves important aspects of pedagogical content knowledge (Carlson & Daehler, 2019).

## **Proposal**

The poster will present in more detail the design of the study, including the planned research phases, as well as the theoretical frames used (e.g., design capacity (Pepin et al., 2017); learning progression (Fonger et al., 2018); different modes of reasoning (Stacey & Vincent, 2009) and expected outcomes. In addition, selected preliminary results related to the context and needs analysis will be presented, e.g., a framework for textbook analysis regarding R&P, and a survey on in-service mathematics teachers' use of resources for designing and conducting lesson plans.

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