

Unveiling the Dynamics of Preservice Teachers' Engagement with Mathematical Modeling through Model Eliciting Activities: A Comprehensive Exploration of Acceptance and Resistance Towards Modeling and Its Pedagogy

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Abstract : Despite its global significance in curricula, mathematical modeling encounters persistent disparities in recognition and emphasis within regular mathematics classrooms and teacher education across countries with diverse educational and cultural traditions, including variations in the perceived role of mathematical modeling. Over the past two decades, increased attention has been given to the integration of mathematical modeling into national curriculum standards in the U.S. and other countries. Therefore, the mathematics education research community has dedicated significant efforts to investigate various aspects associated with the teaching and learning of mathematical modeling, primarily focusing on exploring the applicability of modeling in schools and assessing students', teachers', and preservice teachers' (PTs) competencies and engagement in modeling cycles and processes. However, limited attention has been directed toward examining potential resistance hindering teachers and PTs from effectively implementing mathematical modeling. This study focuses on how PTs, without prior modeling experience, resist and/or embrace mathematical modeling and its pedagogy as they learn about models and modeling perspectives, navigate the modeling process, design and implement their modeling activities and lesson plans, and experience the pedagogy enabling modeling. Model eliciting activities (MEAs) were employed due to their high potential to support the development of mathematical modeling pedagogy. The mathematical modeling module was integrated into a mathematics methods course to explore how PTs embraced or resisted mathematical modeling and its pedagogy. The module design included reading, reflecting, engaging in modeling, assessing models, creating a modeling task (MEA), and designing a modeling lesson employing an MEA. Twelve senior undergraduate students participated, and data collection involved video recordings, written prompts, lesson plans, and reflections. An open coding analysis revealed acceptance and resistance toward teaching mathematical modeling. The study identified four overarching themes, including both acceptance and resistance: pedagogy, affordance of modeling (tasks), modeling actions, and adjusting modeling. In the category of pedagogy, PTs displayed acceptance based on potential pedagogical benefits and resistance due to various concerns. The affordance of modeling (tasks) category emerged from instances when PTs showed acceptance or resistance while discussing the nature and quality of modeling tasks, often debating whether modeling is considered mathematics. PTs demonstrated both acceptance and resistance in their modeling actions, engaging in modeling cycles as students and designing/implementing MEAs as teachers. The adjusting modeling category captured instances where PTs accepted or resisted maintaining the qualities and nature of the modeling experience or converted modeling into a typical structured mathematics experience for students. While PTs displayed a mix of acceptance and resistance in their modeling actions, limitations were observed in embracing complexity and adhering to model principles. The study provides valuable insights into the challenges and opportunities of integrating mathematical modeling into teacher education, emphasizing the importance of addressing pedagogical concerns and providing support for effective implementation. In conclusion, this research offers a comprehensive understanding of PTs' engagement with modeling, advocating for a more focused discussion on the distinct nature and significance of mathematical modeling in the broader curriculum to establish a foundation for effective teacher education programs.

Keywords : mathematical modeling, model eliciting activities, modeling pedagogy, secondary teacher education

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