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Impact Sheet

Geraniou, E., & Bretscher, N. (2025). Investigating teachers' beliefs on teaching mathematics with technology: A replication study in England. *Implementation and Replication Studies in Mathematics Education*, 5(2), xx–xx.

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1 Problem Addressed

Integrating digital technology (DT) into mathematics classrooms continues to pose challenges worldwide. Research shows that teachers' beliefs — about pedagogy, self-efficacy, and epistemology — are central in shaping how they use technology. Thurm and Barzel (2022) conducted a large-scale study in Germany examining teachers' beliefs about teaching with technology, self-efficacy, and epistemology, and how these related to modes of technology use. Their results suggested that beliefs about multiple representations are central, self-efficacy is critical for effective integration, and epistemological beliefs play a peripheral role. This study investigates whether these findings are generalizable in the contrasting educational context of England.

2 What is Replicated?

This paper presents a close replication of Thurm and Barzel's (2022) study, which examined the relationships between teachers' pedagogical, self-efficacy, and epistemological beliefs and their reported modes of technology use in mathematics classrooms. While the original research involved 198 experienced secondary mathematics teachers in Germany, this replication focuses on pre-service and early career teachers in England. The study, therefore, tests the extent to which the German findings — particularly the centrality of beliefs about multiple representations, the strong influence of self-efficacy, and the peripheral role of epistemological beliefs — can be generalized to a different national and professional context. In doing so, it not only examines the robustness of the original results but also provides new insights into how teacher career stage and educational systems shape the role of beliefs in technology integration.

3 How Was the Replication Conducted?

The replication was carried out with a sample of 114 pre-service and early-career mathematics teachers enrolled in three Initial Teacher Education programs at a London university. In contrast to the German study, which involved experienced secondary teachers, the participants in this replication were at the beginning of their careers, with limited teaching experience and more varied academic backgrounds. The same multidimensional survey instrument developed by Thurm and Barzel (2022) was administered in its entirety, measuring teachers' beliefs about teaching with technology, their self-efficacy, their epistemological orientations, and their self-reported modes of technology use. The survey was delivered online, offering advantages in terms of data management and accessibility compared to the paper-based format of the original study. Data analysis closely followed the procedures used by Thurm and Barzel, combining descriptive statistics with correlation analysis and canonical correlation analysis to examine the associations among the different belief dimensions and technology use in the English context.

4 Implications and Significance

The replication confirmed the centrality of multiple representations across contexts: teachers in both Germany and England strongly valued DT for linking graphical, algebraic, and numerical representations. However, unlike in Germany, where this emerged as a distinct cluster, in England, beliefs about multiple representations were embedded within a broader dimension that included self-efficacy and all modes of technology use. Findings also confirmed that self-efficacy is strongly associated with technology use, but its role is context-dependent. In England, where DT integration is not mandated, self-efficacy was a critical driver of voluntary adoption. In Germany, by contrast, curriculum mandates diminished this variability, making self-efficacy more narrowly linked to student-centred uses of DT. Finally, the study replicated the conclusion that epistemological beliefs are peripheral to technology use in both contexts, showing little direct influence.

Reference

Thurm, D., & Barzel, B. (2022). Teaching mathematics with technology: A multidimensional analysis of teacher beliefs. *Educational Studies in Mathematics Education*, 109(1), 41–63. <https://doi.org/10.1007/s10649-021-10072-x>.