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IMPLEMENTATION AND REPLICATION STUDIES IN MATHEMATICS EDUCATION 3 (2023) 1–3

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Impact Sheet

Elicer, R., & Tamborg, A. L. (2023). A critical case study on the implementation of computational thinking in mathematics education. *Implementation and Replication Studies in Mathematics Education*, *3*(1), 44–74. DOI: 10.1163/26670127-bja10011

1 Problem Addressed

The paper is situated in a context of introducing computational thinking into mathematics education in primary and lower secondary school in Denmark. Here mathematics teachers typically do not have prior experience with programming. Drawing on experiences from other European countries' curricula that include aspects of computational thinking, an activity was designed and implemented with an expert teacher, who has had extensive experience in programming and computational thinking. Yet, despite the apparent presence of all elements for a successful implementation, the outcomes were not as positive as had initially been expected. The authors of the paper thus inquire the ways in which a teacher adopts an innovation and analyse these ways in terms of sub-processes of implementation as described in Koichu et al. (2021) (see below).

2 What Is Implemented?

The study reported involves the implementation of a sequence of tasks involving programming, computational thinking and mathematics in a manner so that one does not function as a tool for the other. This sequence involves geometry tasks to be addressed with the help of different digital tools (e.g., Scratch, GeoGebra, and Excel); the tasks aimed at the development of the students' mathematical digital competencies (Geraniou & Jankvist, 2019). The tasks, initially designed by the researcher, were adapted to accommodate the expert teacher's teaching style and experiences prior to the implementation.

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3 What Is Researched and How?

The paper reports a critical case study of the implementation of the activity described above by the expert mathematics teacher. The study focuses on three sub-processes of implementation (see Koichu et al., 2021): the teacher's agency over the innovation's structure and content, the adaptation of the innovation to the teacher's pedagogical approach and expertise, and the changes in the teacher's practice to accommodate the innovation.

4 Implications and Significance

The authors' analyses suggest that the challenges were largely related to differences in how the teacher and the researcher (the first author of the paper) interpreted the content of the lesson, and less related to the implementation process itself. This thus emphasizes the need for a rather integrated and negotiated expertise in computational thinking and mathematics in order to reach a successful implementation. More precisely, the analysis suggests that the work with integrating programming and computational thinking into school mathematics is as much a matter of exploring the deep interactions between mathematics and computational thinking, as it is a matter of learning something about programming.

To the best of our knowledge, this study is one of the first to apply the conceptual framework by Koichu et al. (2021), and thus contributes to illustrate the usefulness of this within implementation research in mathematics education. Furthermore, the study contributes a specific small-scale critical-case study of qualitative nature, thus illustrating IRME's previously formulated point that small-scale studies may have important roles in further development and conceptualization of implementation research in mathematics education (Ahl et al., 2022).

References

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