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IMPLEMENTATION AND REPLICATION STUDIES IN MATHEMATICS EDUCATION (2022) 1–3

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Impact Sheet

Koichu, B., Cooper, J. & Widder, M. (2022). Implementation of Problem Solving in School: From Intended to Experienced. *Implementation and Replication Studies in Mathematics Education*, *2*(1), 76–106. DOI: 10.1163/26670127-bja10004.

1 Problem Addressed

The importance of mathematical problem solving (PS) has long been recognized, both as a goal in its own right (students should be able to solve mathematical problems) and as a means toward other objectives of mathematics education, such as abstraction and deep understanding of mathematical concepts and procedures. However, despite decades of research, the practice of PS remains rare in mathematics classrooms in much of the world. In particular, research has shown that activities that designers of instructional resources originally intended as PS are liable to be enacted as drill and practice, a kind of activity that still tends to be dominant in mathematics classrooms. Some researchers have suggested that the limited impact of PS research on the field is due to the lack of a comprehensive theoretical architecture of PS in school settings. They suggest that specifying "what matters" in PS activity could provide the basis for investigating the roles of different stakeholders in achieving the didactic goals of PS in school.

The goal of Koichu et al.'s (2022) article is to introduce a holistic framework which is termed *Problem-Solving Implementation Chain* (PS-IC). The framework is proposed as a conceptual-organizational tool for studying the implementation of PS in school. PC-IC considers the implementation of PS in classrooms as a complex sequence of actions and interactions between agents. The chain begins with an *intended* PS activity, as perceived by a proponent (researcher, developer, or teacher educator) of a PS resource. In professional development settings, *planned* PS is negotiated through interactions among teachers and professional-development facilitators. Subsequently, PS is *enacted* in individual teachers' classrooms, and is *experienced* by individual students in these classrooms. The PS-IC framework is schematically presented in Figure 1.

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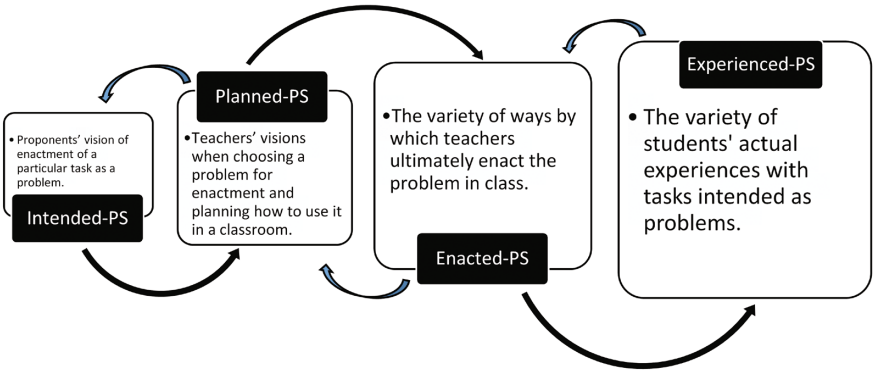

FIGURE 1 Schematic representation of the PS-IC framework

Koichu et al. (2022) first argue — and then demonstrate — that the PS-IC framework can serve as a significant conceptual apparatus in addressing two general classes of research goals: (i) to document and explain how PS resources evolve in interaction between researchers, task designers, professional development facilitators, teachers, and students; (ii) to characterize opportunities for mutual learning emerging from tensions in perspectives on PS held by the different agents involved.

2 What Is Implemented?

The links of the PC-IC are unpacked based on existing theoretical constructs. The intended-planned link is conceptualized in terms of the documentational approach to didactics and boundary crossing in communities of inquiry. The planned-enacted link is seen as refinement of tacit aspects of a lesson plan through relevant in-the-moment decisions taken while interacting with the students. The enacted-experienced link is unfolded in terms of students' PS choices, which are influenced (but not determined) by the teacher's decisions.

Implementation of the proposed PS-IC framework is illustrated through examples from the ongoing Raising the Bar in Mathematics Classrooms (RBMC) project conducted in Israel with about 150 middle-school teachers. Three problems designed by the project team are followed along the links of the chain. The illustration shows that the PS nature of the designed tasks is sometimes preserved and sometimes transformed so that the tasks intended as PS opportunities are experienced by students as means for achieving other instructional goals, for example, practicing the material already taught,

deepening understanding of mathematical concepts or developing competencies of collaborative work.

3 Implications and Significance

The significance of this article is in the theoretical apparatus that it puts forth and in the entailing methodology — both for implementing PS and for researching the implementation. This methodology pertains both to PD activity prior to classroom enactment of PS and to teachers' reflective activity that is shared following enactment. It is demonstrated how mechanisms of communication can generate data and insight into the rationality of agents' decisions along the implementation chain, and can trigger mutual learning across the boundaries that separate communities of researchers, teacher educators, teachers and students.