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# Towards a common understanding of implementation research in mathematics education research

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## Introduction and aim

By reading the papers from TWG 23 in CERME 10, implementation research in mathematics education research appears to integrate diverse sub-fields from the community such as students' proportional reasoning, teachers' professional development, and curriculum design (Jankvist, Aguilar & Wæge & Ärlebäck, 2017). Often, these fields are defined by different research objects, core questions, ongoing discussions and mainstream theoretical and methodological approaches. This is also evident in the papers where the research object being studied is reflected in the choice of theoretical framework, for example, a study of the implementation of proportional reasoning draws on theory of proportional reasoning (Ahl, 2017). This characteristic has several substantial benefits. Firstly, the domain-specific theories developed within sub-areas of mathematics education research have been refined for decades to study the specific objects or processes for which they are developed. Secondly, whether implicit or explicit, domain-specific theories within mathematics education research often involve concepts and a vocabulary to investigate and articulate implementation matters (Jankvist, Aguilar, M. S., Wæge, K., & Ärlebäck, 2017). The use of different theories originating from diverse sub-fields, however, represents a threat in accumulating a solid foundation of knowledge. The aim of this poster is to show that explicitly relating domain-specific theories to implementation research can contribute in overcoming this potential pitfall while simultaneously preserving the advantages of using domain-specific and well-established frameworks. For this poster, I will illustrate how the documentational approach to didactics' (DAD) (Gueudet & Trouche, 2009) perspective on implementation can be articulated by taking an outset in Century and Cassata's (2016) definition of implementation research.

## Theoretical frameworks

Century and Cassata (2016) define implementation research as:

(...) the systematic inquiry regarding innovations enacted in controlled settings or in ordinary practice, the factors that influence innovation enactment, and the relationships between innovations, influential factors, and outcomes. (Century & Cassata, 2016, p. 170)

This definition involves four central elements, namely enactment, factors of influence, innovation and outcome. *Enactment* refers to a given end user's usages of what is being implemented. The *innovation* is what is being implemented, and it might appear in the form of a concept, training program, technology, etc. *Factors of influence* are what affects the enactment and may be attributes of the end user, organizational/environmental factors etc. Finally, *the outcome* is the result of implementation. It is a central point of Century and Cassata (2016) that these four elements are conceptualized and investigated differently in implementation research, as the aim, context and

theoretical approach of a given research question shapes the understanding of these concepts differently.

Central concepts in a framework called DAD can be considered an interpretation of the four elements in this definition of implementation. DAD is developed to study mathematics teachers' appropriation and usage of resources and considers the result of teachers' combination of resources, usages, and knowledge a document (Gueudet & Trouche, 2009). The framework draws on an understanding of resources as "a range of (...) human and material resources, as well as mathematical, cultural, and social resources" (p. 210). Teachers' work with resources is considered dialectic, where usages and resources mutually affect each other (Gueudet & Trouche, 2009). A *document* is defined as the combination of resources, usages, and knowledge. In DAD, teachers' enactment of digital learning platforms are goal-oriented appropriation and usage of resources. The innovation may be the resource, which a teacher use. The outcome may be considered the documents that are produced, and the implications that these might have for teachers' teaching and pedagogical work. In DAD, the influencing factors can be considered emerging instrumentations and instrumentalizations, which may be caused by resources, students, and teachers' interpretation of the learning platform or the like. Moreover, implementations of innovations are considered a bidirectional process where the user may affect the innovations, but the innovation may also affect the user. To synthesize the research results in implementation research as an independent sub-field in mathematics education research there is a need for a consistent vocabulary. In this poster, I have suggested using Century and Cassata's definition of implementation research to create common grounds. Using such an approach can synthesize results generated from diverse frameworks that are otherwise difficult to integrate.

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