Discrepancy between Intention and Realization in an Implementation Research Perspective: When Researcher and Teachers Talk Past Each Other

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Abstract

This article (an extension of a conference paper presented at cerme12; Østergaard & Jankvist, 2022) discusses influential factors in the longitudinal implementation of an innovation concerning students’ beliefs, especially reflection, in mathematics education. Here, the researcher constantly found herself “talking past” the two involved teachers. In the search for a deeper understanding of the discrepancy between the intended and the realized outcome, qualitative data collected in planning sessions and classroom observations are analyzed by applying theoretical constructs from implementation research. In particular, three influential factors appeared to play a central role in the case presented in the paper: characteristics of the end-users, attributes of the innovation, and implementation support strategies. The findings suggest that some of these factors may even have been contradictory to the intentions of the innovation. Furthermore, the article also contributes to the discussion of whether small-scale, qualitative studies have a role to play in implementation research, illustrating how a deeper understanding of the processes involved can be achieved.

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Keywords

beliefs – case study – implementation – influential factors – reflection – small scale
1 Introduction

As pointed out by Ahl et al. (2022), the issue of scale has recently been a central topic for discussion within implementation research. On several occasions, it has been argued that implementation research (IR) in mathematics education should concern the scaling-up of innovations (e.g., Roesken-Winter et al., 2021). Burkhardt and Schoenfeld have argued that although so-called “existence-proofs” are valuable, “implementability should surely aim to mean implementation on a significant scale” (2021, p. 1002). While I of course acknowledge the importance of scaling-up in mathematics education, Coburn’s (2003) reconceptualization of scale suggests that dimensions such as depth, sustainability and shift in reform ownership should be added to the more traditional dimension of spread when addressing the issue of scale. When aiming to scale-up an innovation, the effort may therefore include matters that are more dependent on an understanding of the individual user’s perspective and context. Such an understanding may even be a prerequisite for a successful scaling-up in terms of spread. However, investigating the depth of an implementation, for example, or the shift in reform ownership, requires an investigation of the mechanisms involved in the implementation process from the individual user’s perspective. Furthermore, the context of the implementation is likely to be of great significance to these dimensions. Hence, small-scale studies are often necessary to investigate the complexity of the users’ views, including the context in which they are situated. In addition, an understanding of how and why the dimensions of depth, sustainability, and shift in reform ownership may contribute to scaling-up, as well as to successful implementation, thus involves qualitative approaches. Questions concerning scaling-up therefore relate to qualitative issues as well as the quantitative matter of scope or spread. As such, small-scale, qualitative studies in IR may indeed still have something to offer to IR, just as IR may have something to offer to the explanation of phenomena present in mathematics education research. In relation to “implementability”, I thus align myself with Levine and Cooper (1991), who define the “implementability” of an innovation in an educational context to be the indication of how realistic and feasible it is for practitioners to implement it (this definition does not address the issue of scaling-up as such).

In a qualitative, longitudinal study of students’ beliefs about mathematics as a discipline, I experienced that despite good intentions, long preparations, careful planning and coaching of the involved teachers, the “reality” of what was implemented in class was far from the agreed-upon, initially-designed
activities. I hypothesize that constructs from IR may shed light on this. Hence, the research question may be phrased as: *In what respect can theoretical constructs from IR provide a theoretical lens for explaining the phenomenon when researchers and teachers speak past each other in implementation projects?* This article thus addresses influential factors in relation to the implementation of teaching units designed to foster reflections with students in relation to the nature of mathematics as a discipline. Through a key case of the planning, enactment, and evaluation of a 90-minute lesson from the longitudinal study, I investigate IR constructs as an explanatory framework for the discrepancy between intentions and realization. The case is thus used to illustrate a general phenomenon in implementation projects, not only one that occurred in this specific project (Thomas, 2011). With the answer to the research question, I hope to illustrate how IR may offer an explanation for phenomena present in qualitative studies, and also how qualitative small-scale studies have a role to play in the emerging field of IR in mathematics education research.

2 Setting the Scene — The Overall Project and the Central Element of Reflection

The two-year longitudinal study began in 2019 in two Danish 6th grade classes (students age 11–12). The study used a design-based research approach, involving two mathematics teachers in the design of certain teaching principles, as well as in the implementation, evaluation, and adjustment of these principles in iterative cycles. The hypothesis was that a longitudinal change of focus in the teaching of mathematics might contribute to a change in the students’ beliefs about mathematics — specifically that their beliefs about mathematics as a discipline might be influenced through an increased focus on what Niss and Højgaard (2011, 2019) call *mathematical overview and judgment*.

The notion of overview and judgment (OJ) is presented in the competencies framework described in the so-called KOM report, “Competencies and Mathematical Learning” (Niss & Højgaard, 2011), which was first published in Danish in 2002 and has become widely implemented at all levels of mathematics education in Denmark. In this framework, OJ is identified as an essential part of possessing mathematical competence, which is defined as: “[H]aving knowledge of, understanding, doing, using and having an opinion about mathematics and mathematical activity in a variety of contexts where mathematics plays or can play a role” (Niss & Højgaard, 2011, p. 49).
According to the authors of the report, mathematical competence relies on two main pillars. The first pillar comprises eight action-oriented mathematical competencies\(^1\), defined as “well-informed readiness to act appropriately in situations involving a certain type of mathematical challenge” (Niss & Højgaard, 2011, p. 49). The second pillar is constituted by the notion of overview and judgment in three aspects of mathematics:

**OJ1.** The actual application of mathematics in other subjects and practice areas.

**OJ2.** The historical development of mathematics.

**OJ3.** The nature of mathematics as a subject area.

Unlike the aforementioned mathematical competencies, these three forms of OJ are not behavioral, but are characterized as a set of views that aim to develop active “insight into the character of mathematics and its role in the world” (Niss & Højgaard, 2011, p. 50). They are based on both knowledge and beliefs about mathematics as a discipline (Jankvist, 2015). In the overall study, the notion of OJ thus formed the basis for the intervention and the designed teaching principles. Even though the principles were adjusted along the way, four main principles were consistent during the two years of intervention. That is, all teaching modules\(^2\) included:

1. **Concrete examples** of the application and/or the historical development of mathematics.
2. **Mathematical problems and methods.**
3. **Dialogue** about the application, the development, and/or the nature of mathematics.
4. Individual and/or shared **reflection.**

Philipp (2007, p. 258) defines beliefs as “lenses through which one looks when interpreting the world.” Due to their stability and psychological importance, students’ beliefs can be both difficult and time-consuming to change (Green, 1971). A central element in this process is **reflection**, which is emphasized in teaching principle 4. Beliefs that are developed based on experiences or reason can be said to be **evidentially** held. In contrast, **non-evidentially** held beliefs are either transferred from others (e.g., teachers, parents, stereotypes, etc.), or derived from already existing beliefs, and these tend to be more difficult to change with reason, for example if new information or experience contradict existing beliefs. Non-evidentially held beliefs can often be illustrated as

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\(^1\) The distinction between competence and competency is intentional and used to distinguish the overall concept of mastering mathematics (competence) and the action-oriented competencies.

\(^2\) A module is here understood as a period of approximately two to four weeks’ duration, spent working with a specific topic.
convictions of the sort that are impossible to argue against. In contrast, if a person’s beliefs are evidentially held, there is an increased chance of reconsideration of the validity of these beliefs if the person is presented with new evidence. Hence, when educating students, attention must be paid to providing examples and opportunities for experiences on which they can base and develop their beliefs to ensure that these are evidentially held. However, if such beliefs are to last, the provided evidence must necessarily be followed by reflection. Relations between beliefs are established when reflections are considered and assessed (Green, 1971). These relations are what include and maintain beliefs in a cluster, hence making them more stable. “Reflection” thus played a central part in the intervention.

Dewey (1933) defines reflection — or reflective thinking — as an “active, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and further conclusions to which it leads” (Dewey, 1933, p. 118). It is thus essential that students actively consider their beliefs, which presupposes that they are aware of their beliefs. Often, however, we are not conscious of many of our beliefs (Furinghetti, 1996). If we are not presented with information related to our beliefs, or asked about them, we do not necessarily consider them (Lester, 2002). Therefore, the teaching must offer opportunities for students to articulate their beliefs in order to become aware of them, thus enabling reflection.

Hence, the main focus of the overall study was the development of students’ beliefs, rather than the teachers’ professional development. However, as the present study addresses issues related to the implementation process within the overall study, the teachers thus become the focus here. As Gregersen et al. (2019) point out, teachers’ principles-knowledge can increase their experience of an innovation’s relevance. The participating teachers were thus introduced to the importance of reflection in the initial phase of the study. The above-mentioned connection between changing beliefs and students’ reflection was communicated in two ways. First, a document was provided that stated the purpose of the intervention and the role of reflection in changing or developing students’ beliefs. The word “reflection” was highlighted and mentioned five times in the document to illustrate its centrality. Second, the document was discussed in a subsequent meeting between the teachers and me as researcher, and where the importance of reflection was further emphasized. In addition, we regularly discussed the concept of reflection and possible ways to implement it in practice during the two years of intervention, when the three of us met approximately once or twice per month for collaborative planning, evaluation, and discussion. In the following section, I present an illustrative case of how the two teachers attempted to realize the intended teaching principles, with a special focus on creating room for the students’ reflection.
about mathematics as a discipline. However — as I will return to in the discussion — the case might suggest that, despite the explicit emphasis on the importance of reflection as well as comprehensive discussions of both theoretical and practical perspectives on and of reflection, a clear consensus on the concept may not have been reached.

As described, the primary focus of the overall project was developing the students’ beliefs and not the teachers’ ability or possibility to implement the principles. Neither was the focus on the teachers’ understanding of the principles behind the intervention — for example, the concept of reflection — or the implementation process. Still, these factors were, of course, a prerequisite for a successful intervention and therefore included in the research design, although only as secondary considerations. The data collection did not specifically include data concerning the teachers or the implementation, but was instead directed towards the students through a qualitative questionnaire, interviews with four selected students, and approximately 100 hours of video recorded classroom observations with accompanying field notes (for further elaboration, see Østergaard, 2022). Also, I audio recorded all planning and evaluation sessions with the teachers, partly to allow recalling our decisions and discussions, and partly to ensure a high level of transparency in my research. However, in retrospect, the implementation of the principles, and the teachers’ role in this process, seemed to play an essential part in the results of the study — a fact that became increasingly clear to me during the intervention (particularly in its last phase), in the subsequent analysis of the data, and in the review of the classroom observations. Therefore, the present study on the implementation process does not build on data collected with an implementation study in mind. Instead, I have selected a case that illustrates the general phenomenon that I seek to explore, namely the discrepancy between intention and realization in educational implementation processes, thus conducting what Creswell (2007) terms a single instrumental case study, where “the researcher focuses on an issue or concern, and then selects one bounded case to illustrate this issue”. My study case is an “extreme case” (Flyvbjerg, 2006), as the discrepancy between intention and realization appears particularly clearly. The case revolves around a lesson concerning probability that was planned in collaboration between the two teachers and myself. I investigate three phases of the implementation process: planning, enactment, and evaluation. Thereby, I am able to compare the intention, the realization, and the teachers’ considerations behind any deviations from the intention agreed upon in the planning phase. In addition to being especially illustrative, this case was selected based on at least three considerations. Firstly, it is quite representative of the general working process related to my collaboration with the teachers about planning the teaching. Secondly, it specifically concerns the
implementation of reflection, which was the teaching principle that seemed the most challenging to the teachers. Thirdly, I was in possession of data from both the planning phase of the specific lesson, the enactment in both classes, and the evaluation phase. Although the case includes implementation in two different classes, I regard it as one case, as the planning and evaluation were collaborative, thereby making the intention of the two lessons identical.

The data thus include audio recordings of planning and debriefing sessions, as well as video recordings and field notes from the lessons in the two classrooms. Furthermore, excerpts from a meeting six months prior to the lesson are included to illustrate the teachers’ general considerations about students’ reflections. Relevant excerpts of both audio and video recordings have been transcribed. In the analysis of the data, three theoretical constructs from IR, which are elaborated in the following section, are applied, thus seeking an explanation to the apparent miscommunication between researcher and teachers regarding the concept of reflection within the overall study.

3 Implementation Research Theoretical Constructs

When attempting, as in the longitudinal study, to change educational practices, the complexity of the setting fosters a variety of factors influencing the process, depending on both the characteristics of the innovation and the level of change (e.g., individual or organizational level). At an individual level — as in the case in this article — a change in practice for a teacher can be both challenging and psychologically threatening, as well as cause doubts and uncertainties (Century & Cassata, 2016), even when the intended change might not seem difficult to its promoter. Other influential aspects might be the character of the innovation, environmental factors, support strategies, or time. Century and Cassata (2016) present a list of factors that might influence the implementation of an innovation: spheres of influence, characteristics of end-users, organizational and environmental factors, attributes of innovation, implementation of support strategies, and implementation over time. Here, I address and connect three them in the analysis of the selected case: characteristics of end-users, attributes of innovation and implementation of support strategies. These have been selected according to their level of relevance for the implementation process in the case. In addition, considerations connected to the teachers’ beliefs and their influence on the implementation process are included in the analysis as part of the characteristics of end-users.

The characteristics of individual end-users of an innovation (who are, in this case, the teachers, as I investigate the implementation of teaching principles)
can potentially play a crucial role in an implementation process, not least in innovations that give room for the users’ interpretations and adaptations. Prior knowledge, individual competency, professional identity, and feeling of agency are all examples of factors that might influence implementation. In this regard, Rogers (2003) mentions different types of knowledge connected to the implementation process, e.g., how-to knowledge (practical knowledge about how to apply the innovation), and principles-knowledge (understanding the thoughts and goals behind the innovation). Century and Cassata divide the characteristics of the end-users into two types: (a) those related to the innovation, “e.g., level of understanding, expertise, prior experience, beliefs, values, attitudes, motivation, or self-efficacy” (Rogers, 2003, p. 185); and (b) those existing independently of the innovation, “e.g., willingness to try new things, organizational skills, classroom management style, or views about teaching and learning in general” (Rogers, 2003, p. 185). As the teachers played a central role in the longitudinal study and in addition had quite diverse characteristics, this factor seems relevant for the present study.

Coburn (2003) includes teachers’ beliefs as a crucial element in the depth dimension of an implementation process. Several researchers have pointed to a necessary distinction between a teacher’s espoused and enacted beliefs (e.g., Cooney, 1985; Eichler, 2011; Furinghetti, 1996), as these often do not match. For example, some teachers may be influenced by the curriculum in their peripheral beliefs, while having deeply rooted beliefs about teaching that are not compatible, resulting in what Furinghetti (1996) terms “ghosts in classrooms”. According to Ernest (1989), a teacher’s beliefs is one of the key elements in the practice of teaching, building on the teacher’s conception of three aspects: the nature of mathematics, the nature of mathematics teaching, and the process of learning mathematics. Ernest (1989, p. 249) identifies three philosophies of mathematics among teachers:

1. The instrumentalist view, where mathematics is seen as “a set of unrelated but utilitarian rules and facts”. The teacher is perceived as an instructor, and learning as connected to “compliant behavior and mastery of skills”.
2. The Platonist view, which characterizes mathematics as “a static but unified body of certain knowledge” that is discovered and not invented. Here, the teacher is viewed as an explainer, and learning as the reception of knowledge.
3. The problem-solving view, with a perception of mathematics as “a dynamic, continually expanding field of human creation and invention”. This view can be linked to perceiving the teacher as a facilitator and learning as active construction of understanding.

If a teacher’s beliefs do not build on the same view of mathematics as the principles behind an innovation, they can affect the implementation process. For
example, an innovation that is based on a problem-solving view of mathematics will very likely require the teacher to take the role of a facilitator. However, the teacher might have a more instrumentalist or Platonist view of mathematics, thus engaging in the implementation from a different perspective. In the case of this study, the teachers’ views of mathematics are approached through an interpretation of their statements and actions according to Ernest’s three categories.

Attributes of the innovation concern both objective characteristics of the innovation, and subjective user perceptions (Century & Cassata, 2016). The objective characteristics may, for example, include the innovation's level of complexity, its design features, or costs. Also, the degree of specification is a central attribute of an innovation. Some innovations are rather explicit (e.g., curricula), specifying the innovation in detail, which does not leave room for the users’ adaptations. Others — as the innovation in which the case study is situated — are more ambiguous and thereby more dependent on the interpretation and realization of the users. Subjective attributes are related to the characteristics of the end-user and may vary according to the users. They concern, for example, the users’ perception of the relevance, or ease of use, of the innovation, their familiarity with the components, or their perception of the innovations’ adaptability to the circumstances in which it is implemented. In this study, both objective and subjective attributes of the longitudinal study had a significant impact on the implementation process, as will be elaborated in section 5, hence making it relevant to include this factor in the analysis.

Support strategies can be essential to an implementation process and should ideally, according to Century and Cassata (2016), be included in the design of an innovation, based on underlying theories. The main purpose is to support the users in the realization of the innovation and in their process of change, and it may be offered externally by, for example, the promoters of an innovation, or internally in the implementing organization; for instance, by a supervisor. Support strategies can appear in various formats, such as professional development, strategic planning, mentoring, or evaluative processes. The longitudinal study presented here depended largely on support strategies connected to the collaboration between the two teachers and me. At times, the design of the support strategies was the cause of dilemmas and led to some of the more comprehensive adjustments in the implementation process. Hence, this factor is included in this study.

In the following section, I present the illustrative case of planning, implementing, and evaluating a lesson. I then investigate whether theoretical constructs may clarify why the intentions behind the intervention were not always realized in practice. I analyze the case by studying these three influential factors, thus performing what Yin (2003) terms an embedded analysis of specific
aspects of a case. The three factors are analyzed both individually and in interplay in relation to the longitudinal study, investigating how they may have influenced the implementation process, exemplified in this particular situation by the planning, enactment, and evaluation of a lesson. By comparing the characteristics of the end-users, the attributes of the innovation, and the support strategies of this specific intervention, and not least their intended role in the design of the longitudinal study, the analysis particularly focuses on where and how they either support, contradict, or even hinder each other. More specifically, the characteristics of the end-users include facts about the two teachers’ backgrounds, my interpretations of their statements in the planning phase, and their actions in the classroom — statements and actions that might reflect their principles-knowledge and how-to knowledge as well as their beliefs about mathematics within Ernest’s (1989) categories. As mentioned, the data collection was not initially directed towards the teachers, meaning that especially a study of their beliefs may only rely on what can be inferred from their statements and actions. The analysis of the intervention’s attributes primarily focuses on the level of explicitness in its design and how this matches the teachers’ level of required and actual principles- and how-to knowledge. Lastly, the support strategies included in the intervention design are described, and compared to the interplay between the characteristics of the teachers and the attributes of the intervention, especially concerning the support strategies’ abilities to prevent or reduce any potential gaps between these.

4 An Illustrative Case

The teachers participating in the study were two very different practitioners, both in terms of experience and in their contribution to the intervention. Teacher 1 was new to the job, and had no prior teaching experience; she was still attending courses to get her teaching diploma, and felt somewhat insecure about her teaching. Thus, she was both open to and grateful for every idea, discussion, and input presented in our collaboration.

Teacher 2 had 20 years of teaching experience and was the school’s mathematics counselor. Hence, she contributed to the implementation of the teaching principles with many valuable inputs and ideas, yet she was still open to new ideas and very interested in her own professional development. Six

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3 In most Danish schools, one of the mathematics teachers functions as a mathematics counselor. The counselor has typically gone through PD courses (60 ECTS) related to counseling, mathematics teaching and learning, as well as educational knowledge and research.
months into the intervention, teacher 2 explained how the teaching principle related to reflection had caused her to be “more systematic about individual and shared reflection, and what it can be used for”. Despite her comprehensive experience, she still felt that the principles, in general, made her more aware of her teaching choices. When teacher 1 described her difficulties with implementing reflection, teacher 2 even argued for why reflection is important, and how she motivated her students to reflect:

I have spent time in the class talking about short-term memory and remembering to bring it [the learned content] back to the working memory — you need to think about it, and bring it back. And if you don’t do that several times, the brain will toss it. (...) So, there is a reason that we do it [reflect].

Hence, teacher 2 appeared to be well aware of the importance of reflection and its role in the project. However, she also gave a small hint of doubt, expressing that — like teacher 1 — she was unsure that she was always able to transfer her intentions “all the way into the classroom”. The following case, which confirms this doubt, took place six months later (a year into the intervention).

4.1 Planning
As mentioned, the teachers and I arranged regular planning and debriefing sessions to discuss the project and possible ways to implement the designed teaching principles. These meetings were held jointly so that we could exchange experiences, ideas, and doubts. Although the teachers were generally responsible for planning the lessons based on the principles, we decided to design some of the teaching collaboratively, partly to establish a link between theory and practice. To ensure that the purpose of the intervention was met, I therefore participated in the planning of at least one lesson within every teaching module. In a module about probability, the topic of a 90-minute lesson was chosen to be the historical development of the field, exemplified in Pascal and Fermat’s approaches to solving the question of distributing stakes in an unfinished game of chance, as presented in a simplified version by Berlinghoff and Gouvea (2004). The problem concerns a game of flipping a coin for two players (player X and player Y). Each player stakes €10 and tosses the coin in turn. If heads, the player tossing the coin gets a point; if tails, the other player receives a point. The winner is the first player to reach three points. However, the game is interrupted, when the score is 2–1 in favor of player X, who is about to toss the coin, and the distribution of the €20 stakes is to be decided. The planning of the lesson was based on Chapter 21 of Berlinghoff and Gouvea (2004, pp. 207–214): “What’s in a Game? The Start of Probability Theory”. This chapter
describes the story, and the mathematical theory behind the problem, as well as the methods used for solving it.

Since both teachers had expressed some doubts about how they could implement the teaching principle concerning reflection, we agreed that the students’ considerations, suggestions, reflections, and discussions should be the focus of the lesson. Space for reflection would be given in the students’ discussions of each other’s solutions, and the relation to the solutions of Pascal and Fermat.

Due to her lack of experience, teacher 1 generally hesitated to make suggestions in our joint planning sessions. This session was no exception, and she mostly contributed with questions and concerns related to the execution of the plan, ensuring that theoretical ideas were transferred into concrete plans for action. For example, she expressed doubts about the element of shared reflection in her class, as “[the students] are not good at talking to each other. There is a somewhat unhealthy environment in the class”. This led to a discussion of how reflection can happen in various settings and organizations, as well as which topics, issues, or concrete questions might form the basis for reflection in this particular lesson. In this discussion, teacher 2 contributed with several ideas, and expressed her intention to “let the students consider a solution themselves”, with the purpose of allowing them to “experience frustration and give their contributions”. She also suggested that part of the students’ reflections could regard the validity of the methods presented by Pascal and Fermat. The students should engage in the role of experts, acting as mathematicians, showing them that some of their considerations and conjunctions could be compared to those of Pascal and Fermat. Hence, the element of reflection would primarily revolve around three issues:

1. Methods (How can we investigate the probability of winning for the two players? Did we all use the same method? Can different methods lead to the same result? Are some methods better than others? How can we decide? How do our methods relate to the methods used by Pascal and Fermat?)
2. Mathematical argumentation (How can we explain how we reach a result, and why may we find it correct or preferable? What is important in such an explanation?)
3. Probability and fairness (What does it mean that a game is fair? How can we make sure that a game is fair? Does a game have to be fair to be a good or fun game?)

After an exchange of ideas, the lesson was planned to include five phases, which are listed below. Each of these phases was thoroughly discussed, both
in regard to content and purpose in relation to the goals. Several phases relied on the mentioned book chapter, and thus the teachers needed to be familiar with its main points, especially regarding the mathematical methods involved. Table 1 shows a detailed plan of the lesson, including the content and purpose of each phase.

**Table 1** Phases of the probability lesson

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<th>Phase</th>
<th>Content</th>
<th>Purpose</th>
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<td>1. Staging</td>
<td>Presentation of the game, the distribution problem, and Pascal and Fermat. Told as a story by the teacher.</td>
<td>The purpose of this element is to engage the students by telling a story and inviting them to engage in the game. In addition, the story introduces the historical people, and encourages the students to consider possible distributions of the stakes.</td>
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<td>2. Investigation</td>
<td>Equipped with a coin, the students play the game in pairs, considering and discussing how the stakes might be distributed fairly. The pairs present their suggestions to the class. Pairs with deviating solutions are put together in groups of four to discuss their arguments and attempt to agree on a shared solution.</td>
<td>The purpose is to acquaint the students with the game and make them express their immediate ideas for distribution of the stakes. When presented with other suggestions, the students may become aware that there might be different solutions and different arguments. By including mathematical as well as non-mathematical argumentation, this experience addresses OJ3, the nature of mathematics as a subject area.</td>
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Phase | Content | Purpose
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3. Presentation of the agreed solutions | The groups of four present their solutions along with the considerations and arguments on which they are based, and the strategies used to reach them. | By including arguments and strategies, this phase emphasizes that methods and reasoning are essential aspects of mathematical problem solving, and that they play an important role when making qualified decisions. Thereby, this phase also addresses OJ3.

4. Shared reflection | In a teacher-led classroom discussion, the students consider relevant issues; for example, if some of the presented solutions, methods, or arguments are better or more valuable than others, or if the students can agree on one solution. During this discussion, the teacher presents the methods used by Pascal and Fermat, and the class discusses if they resemble the methods used by the students. | This element provides the students with an opportunity to reflect on their own strategies, the mathematical ideas behind the different solutions, and the validity of mathematical arguments. The classroom format allows the students to build on each other’s ideas and discoveries, and to reflect on other suggestions than those they have thought of themselves. Comparing their ideas to the methods used in a historical context places the problem in both a historical and mathematical perspective. The character of mathematical methods is thereby exemplified, showing the students that they are capable of engaging in problems that “real” mathematicians struggled with. It is essential that the teacher summarizes and emphasizes the mathematical and methodical main points that the class might reach.
The two teachers carried out the lesson in each of their classes. In the following, the two enactments are described separately.

4.2 Enactment in Class 1

4.2.1 Phase 1: Staging
Teacher 1 had rewritten the story and read it out loud. Prior to the reading, she asked the students to pay attention to which mathematical problem might be included in the story, and to take notes (written or drawn) during the reading. She stayed close to the story, mentioning both the year and the names of all persons involved. She read slowly and explained some of the potentially challenging words and concepts along the way (e.g., “stakes”).

4.2.2 Phase 2: Investigation
Seven pairs of students worked in class 1. Handed a wooden coin and eight pieces of paper (money bills working as stakes), the teacher explained that any amount might be noted on the “money bills”. The students were instructed to (1) play the game, and (2) decide which distribution was the fairest. While the students were working, teacher 1 circled among the pairs, making sure that they all understood the task and the rules of the game. An observation of one of the pairs showed how they played out the situation, and decided on a distribution of €15 for Player X, and €5 for Player Y, leaning on the following argumentation that they shared with the teacher:

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<td>5. Wrap-up</td>
<td>The teacher describes the historical development of probability theory, which was initiated by the work of Pascal and Fermat, and the important theories that developed; for example, about expected outcome of the law of large numbers — theories that are now applied in many fields, such as insurance, law, medicine, etc.</td>
<td>The mathematical content area of probability is inserted in a context that illustrates and exemplifies the role of mathematics in the world, thus addressing the application of mathematics (OJ1).</td>
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Student A: To make it fair — because she [student B] has one point more than I do — she gets 15, and I get 5.

Student B: So, I suppose that is fair? [asking for confirmation from the teacher]

Teacher 1: Yes? If you both find it fair —

Student A: We do!

Teacher 1: — then that is a solution. Then you must write down why you believe that it is a good solution.

Student B: But that is difficult to write down.

Teacher 1: Yes, it is difficult with words, but that is the task. It is hard but try anyway.

Student A: [Dictates while writing] Both players place stakes of 10; 20 in total.

Student B: X has one point more than Y, so she gets 15.

Student A: Yes.

The two students did not consider any other distributions, and teacher 1 did not challenge them by questioning why they precisely chose the amounts of 15 and 5. Probably, she wanted to save these discussions for the groups of four, following the intention of the plan. However, it turned out that five of the seven pairs decided on a similar distribution, while the two remaining pairs respectively suggested a 10/10 distribution, and a $\frac{13}{2}/\frac{13}{3}$ distribution. Since most groups had similar solutions, teacher 1 made the choice of skipping the discussion in groups of four.

4.2.3 Phase 3: Presentation of the Agreed Solutions.

Instead of forming groups of four, the pairs were asked to, in turn, stand up in front of the class and argue for their solution. The group suggesting a 10/10 distribution argued that since the game was not finished, it would be fairest to return the stakes so that none of the players received more than the other. The five groups who suggested a 15/5 distribution all gave arguments identical to the one presented above — that the player with the most points should get the most money. One pair mentioned the distribution as 75%/25%. Again, teacher 1 neither challenged their suggestion, nor requested a mathematical argument. The pair suggesting a $\frac{13}{2}/\frac{13}{3}$ distribution used the same argument as the pairs suggesting 15/5, but this time the teacher asked them to explain how they reached these numbers. One of the students explained that they divided the total amount of stakes with the total number of points, giving them an amount to distribute per point. However, the teacher did not invite the class to consider the difference between these solutions, to discuss if one of
them might be more correct or fair than the other, or to engage in calculations of probability.

4.2.4 Phase 4: Shared Classroom Reflection
Omitting the discussion of the solutions and methods of the class, teacher 1 continued reading the rest of the story, thus presenting the solution by Pascal (15/5) as well as the argument behind it. She also mentioned that the work of Pascal and Fermat initiated the development of probability theory. After reading, teacher 1 pointed out that Pascal reached the same solution as many of the students, and then asked the class about their thoughts. One student stated that it made sense that the one €10 bill was split in two. Unfortunately, the class was not given room for reflection on the mathematical methods or arguments. Thereby, only some parts of the plan for this phase were realized.

4.2.5 Phase 5: Wrap-Up
In the last phase of the lesson, teacher 1 linked the story to the task that the students were to work on next (designing a game), by opening up a discussion of the role of probability and fairness in a game. She asked the students if they could think of any games that were fun, even though they might not be fair. One student exclaimed that she did not believe the dice game Yatzy to be fair.

Teacher 1: Yatzy. Why is Yatzy not fair?
Student: Because I always lose!
Teacher 1: That brings us back to what we talked about earlier: How it might be that I always seem to get ones and threes, when my uncle gets sixes all the time. It feels like someone always gets better numbers than you do, when rolling the dice. But statistically and probability-wise, we can agree that it should not be possible, right? Do you remember which “law” I am referring to?
Student: The law of large numbers.

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Footnote: For those not familiar with the argumentation, it relies on the observation that the players have an equal chance of winning with the next toss. If the coin lands on heads, player x will win, thereby receiving the €20. If tails, the score will be even, making an even distribution of €10 to each player most fair. Thereby, player x will in any case be guaranteed €10, and since the probability of heads is equal to the probability of tails in the next toss, the remaining €10 should be distributed evenly, leaving player x with €15, and player Y with €5. Fermat’s argumentation (for the same solution) was not presented in the lesson. Teacher 1 later explained that it was missing from the version of the chapter that I had sent to the teachers and that she only realized this the evening before the lesson.
Teacher 1: When we all were rolling dice ... if you roll the dice enough times, it evens out.

The class then suggested other games that might not be fair, and teacher 1 again pointed out that fairness and probability are important elements to consider when designing a game. The students were then divided into groups and began working on the new task. Hence, teacher 1 were somewhat successful in initiating a summarizing reflection in this phase, and connecting the story and the mathematical problem to both previous investigations and to the next activity.

4.3 Enactment in Class 2

4.3.1 Phase 1: Staging
Teacher 2 told the story about a rich, French, 17th-century nobleman who liked to gamble. The concept of “stakes” and the rules of the game were explained. Pascal and Fermat were never mentioned.

4.3.2 Phase 2: Investigation
After being handed wooden coins and pieces of paper, on which they were told that they could write the number 10, nine pairs of students played the game four times. After a while, teacher 2 stopped the games and asked the students if they believed this game to be fair. Several complained that their coin always landed on the same side. However, teacher 2 neither engaged in a dialogue about the concept of fairness, nor what such a bias would mean in regard to the game. Instead, the students were asked to play again and stop when one player had two points and the other player one point — and then discuss how the stakes should be distributed if the game could not be completed. The students did, and teacher 2 circled between them, asking guiding questions: “How is your distribution fair?” and “Would you both be satisfied with that solution?”. She noticed that most pairs either assigned all the stakes to player X, or shared the stakes evenly, and she stopped the students. When she asked each pair for their solution, this tendency was affirmed. Even though teacher 2 asked questions that might make the students reflect on probability (e.g., “Who has the largest chance of winning?”), they never engaged in any mathematical considerations. Teacher 2 asked them to play again, this time stopping when the points were even. Expectedly, they found the distribution easier, now that the probability of winning was equal for both players, which was pointed out by teacher 2. She now encouraged the students to have a “serious discussion” about the distribution in the case of two points versus one, making them aware of the possibility of exchanging the €10 bills. The pairs were sent on a two-minute walk-and-talk, which should result in an agreed solution to put on the whiteboard. As in class 1, the original intention of putting pairs together with different solutions
was never realized in class 2, and neither was the intention of having the students prepare a mathematical argument for their solution.

4.3.3 Phase 3: Presentation of the Agreed Solutions
The students put their solutions on the whiteboard. Out of nine pairs, four suggested that the €20 were distributed evenly, four suggested a 15/5 distribution and, as in class 1, one pair suggested that ⅔ of the money would go to the player with two points. Teacher 2 merged the last suggestion with the 15/5 solution and asked the class to explain why such a solution might be fair. One student answered: “Because the player with the most points should have the most money.” Teacher 2 asked for an argument behind the 10/10 solution, and another student answered: “Because they have equal chances of winning”. Teacher 2 questioned this by drawing the students’ attention to the minimum number of tosses needed for each player to win. Another student exclaimed: “The chances are not equal, because one player has a 75% chance of winning, and the other has 25%”. Unfortunately, teacher 2 did not elaborate on this rather clever observation, although it appeared an excellent opportunity to engage in mathematical considerations. Neither the mathematical argumentation, nor the strategies to reach a solution, were further discussed.

4.3.4 Phase 4: Shared Classroom Reflection
This phase was not realized in any way.

4.3.5 Phase 5: Wrap-Up
Teacher 2 returned to the story of the French nobleman, who actually met this exact problem and consulted “some mathematicians”. Pascal and Fermat were still not mentioned by name. Their methods and solutions were only mentioned as follows:

What they came up with was actually what some of you suggested. Their solution was 15/5, because there is a difference in the players’ chances of winning. They reached their solutions in a slightly different way, as you reached yours differently. And they were great mathematicians [...]. And you were also able to do this. And this was the beginning of the kind of mathematics that deals with probability.

Hence, the intentions of comparing the solutions and methods of both each other, and of Pascal and Fermat, were never realized, despite it being the main goal of the lesson. Although teacher 2 briefly touched upon a mathematical argument for the distribution of stakes when mentioning the minimum number of tosses needed for a player to win, the mathematical content was neither
presented nor discussed, and the historical significance was only mentioned in passing. Most unfortunate was that the students were not offered the intended opportunities for reflection.

4.4 Evaluation

The subsequent debriefing took place four days after the lesson in class 2, and on the same day as the lesson in class 1. Here, teacher 1 was very positive about the structure of the lesson, and she stated that she liked having a fixed plan, ensuring that all teaching principles would be met. In contrast, teacher 2 expressed that her class was not used to working in such an “unstructured manner”, and neither was she (this was not specified any further, though). Neither of the two teachers addressed the skipped activities of reflection, nor did teacher 2 mention the lack of the historical dimension. Teacher 2 admitted that she did not thoroughly read the chapter on probability, which may have been the reason for the lack of mathematical content in the lesson. However, she presented a mathematical argument for the 15/5 solution in the following mathematics lesson (following a suggestion from me), by studying the possible scenarios that could have occurred had the game continued. Teacher 1 stated that she intended to include calculations of probability in the activity concerning the students’ design of a game of their own.

Both teachers expressed that they had found it difficult to get the students to use mathematical argumentation. This led to a discussion of — but not an actual answer to — how the students could be supported in their argumentation, so that it could be more mathematically founded. We considered how we might make the students aware of what constitutes mathematical argumentation (e.g., in contrast to the argumentation used by the students in relation to the suggestion of a 10/10 distribution of the stakes), as well as in which situations it might be used, and how a mathematical argument can be constructed. By reviewing some of the potentials that were not realized, for instance in relation to mathematical discussions about different solutions to the distribution problem, we decided to adjust our strategy in the planning phases of the following teaching modules. It would now include a more thorough preparation and discussion of the mathematical content, as well as reflections on potential student responses and appropriate teacher reactions, prior to an activity.

Hence, I did not explicitly confront the two teachers about the omitted elements of reflection. Instead, I chose to listen to their perspectives on the lessons, and then address the lacking elements through suggestions for potential improvement in our future planning. This choice was based on considerations concerning how the teachers’ feeling of ownership and agency could best be preserved and how the allocation of expertise might be kept intact, which will
be further elaborated in the analysis of the attributes of the innovation in the following section.

5 Analysis of the Case in Terms of Implementation Research

5.1 Characteristics of End-Users

There appeared to be a discrepancy between the two teachers’ characteristics in relation to the innovation and those existing independently of the innovation. Teacher 1 was, as mentioned, at the beginning of her teaching career and thus had little experience. She was primarily preoccupied with finding her way in the job and establishing her own identity as a teacher, and therefore welcomed all suggestions, inspirations, and directions that were offered in the intervention and in the collaboration with her experienced colleague and me. She was not afraid to raise questions regarding doubts or to seek advice, thus acknowledging her lack of how-to knowledge, and was responsive to ideas for how the intentions of the innovation might be realized in practice. On one hand, she showed signs of a low level of principles-knowledge when expressing insecurities in relation to the principles of the intervention in the planning phase. On the other hand, her enactment of the planned lesson and her comments in the evaluation pointed to some degree of understanding; for example, regarding the purpose of emphasizing the historical dimension of the mathematical problem, and relating the students’ work to the application of probability theory. Based on her comments in the evaluation, it is possible that the detailed planning and the structure of the lesson supported her how-to knowledge. However, the lack of reflection-oriented activities might have implied either inadequate principles-knowledge about the importance of reflection, or a lack in how-to knowledge — or perhaps both.

Teacher 2 was an expert teacher, with a strong professional identity. She often advised her colleagues on mathematics teaching and learning. Concerning the innovation, she was highly motivated and perceived the innovation as relevant, both for her teaching and in her professional development. Her statements in the planning phase indicated that she was very aware of the innovation’s intention and that she had a clear idea of how it was to be implemented. This case, however, reveals that even though she possessed this principles-knowledge of the innovation, she might not have had adequate prior experience with the intended teaching approach, and thus her how-to knowledge was insufficient. Furthermore, her comments during the evaluation phase may be a sign that her identity as an expert teacher was threatened by the uncertainties and doubts that she experienced during the lesson. The fact that she did not mention the skipped activities of the lesson plan, which
primarily involved reflection, seemed to indicate that she was not as aware of this purpose, contrary to what she expressed during the planning. Yet, it could also be a sign of denial of a feeling of failure or inadequacy.

The discrepancy between our didactical discussions in the planning session and the enactment in the classroom may also be related to the teachers’ beliefs and the principles behind the intervention, which to a large degree appeared to align in a problem-solving view of mathematics (Ernest, 1989), judging from their general expressions in the didactical discussions and in the overall planning of the lessons. In this case, both teachers were engaged in designing activities that would support the students’ construction of understanding. Still, the teachers took the role of explainer in several situations; for example, in the presentation of the solution to the distribution problem, thereby displaying a more Platonist view of learning as reception of knowledge.

5.2 Attributes of the Innovation
As the intervention was based on a small number of somewhat general principles (cf. Section 2), the level of explicitness was quite low. Hence, the implementation of the principles was highly dependent on the interpretation and realization of the teachers, requiring a high level of how-to knowledge. This meant that the final and determining decisions in the classrooms were in the hands of the teachers, and thus became the realized innovation. Despite the shared planning of the presented lesson (supporting the teacher’s how-to knowledge), and the regular and thorough discussions regarding the centrality of reflection for the development of beliefs (principles-knowledge), both teachers still decided to leave out the activities that offered possibilities for the students to actually reflect. Furthermore, to promote the teachers’ feeling of agency in the innovation, the allocation of contributions was that I, as a researcher, would primarily function as a theoretical expert, and the teachers as experts on practice. Consequently, the teachers were responsible for the detailed planning and preparation of lessons. As exemplified in this case, on one hand this enabled them to adapt the teaching to their individual approaches and to the students. On the other hand, I had even less control of the actual implementation of the innovation, and the risk of non-intended realization increased (significantly).

5.3 Implementation Support Strategies
As suggested by Century and Cassata (2016), several theoretically-based formats of support were included to assist the teachers in the implementation process. For example, the “whys and hows” related to the concept of reflection were carefully discussed to enhance the teachers’ principles-knowledge — a strategy that generally seemed to benefit their experience of relevance, as
seen in Gregersen et al. (2019). These support strategies were further developed during the study. Central to the cooperation between the teachers and me were the collaborative planning and evaluation sessions. In this case, the planning not only included discussions and clarification of focus the main purpose of the lesson (*principles-knowledge*), but also a description of a lesson’s activities and purpose (*how-to knowledge*). This kind of detailed planning had not previously been conducted in cooperation with me, but an increased awareness of the challenges connected to the implementation led to this initiative, which was welcomed by both teachers. Likewise, the described case became, as mentioned, the cause of further adjustments to the support strategy, eventually including shared preparation and considerations of potential student responses and appropriate teacher reactions. What was not included in the support strategies of the overall study was an actual strategy for professional development. As the study focused on the students’ beliefs, addressing the teachers’ competences or prerequisites was not prioritized in the design, and the initial information about key elements (e.g., reflection) were considered adequate to ensure that they understood the principles behind the intervention.

6 Discussion

To explore the explanatory power of the selected theoretical constructs in relation to the phenomenon of discrepancy between intended and realized implementation, it is necessary to compare and connect the three influential factors concerning characteristics of teachers, attributes of the longitudinal study, and its support strategies. When doing so, interesting issues related to the implementation process are revealed.

Firstly, the attributes of the innovation define the teachers as experts on practice, thus making them responsible for the realization of the intention. However, the characteristics of these specific teachers made this realization unpredictable. For example, the significant difference between the two teachers may have affected the discourse in our sessions, as much time was spent accommodating their dissimilar needs. Where teacher 1 largely requested a form of counseling to support her *how-to knowledge*, teacher 2 was occupied with general didactical considerations. Still, teacher 2 also took on her role as a mathematics counselor or a form of mentor for teacher 1. It thus might be worth considering whether separate planning sessions would have been preferable, as this would have made it easier to accommodate their divergent needs. However, there are signs in the case that the issues that preoccupied the teachers in the planning phase did not necessarily reflect their actual needs...
in the classroom. For example, teacher 2 seemed very confident both in her principles-knowledge and her how-to knowledge during the planning session, but apparently did not have the tools to realize the intention in the classroom. In contrast, teacher 1 expressed a high level of insecurity concerning her how-to knowledge, but actually managed to realize a wider range of the intention than teacher 2, although she also omitted essential parts connected to the students’ reflection. Instead of separate planning sessions, a stronger awareness of their actual needs, and not only their expressed needs, might have contributed to more fruitful discussions in the joint sessions and, to a higher degree, let the two teachers benefit from each other’s experiences and questions. A stronger attention to, and inclusion of, the IR theoretical constructs in the design of the support strategies might have heightened such an awareness.

In some way, the discussions in our joint sessions included theoretical issues as well as practical issues, but the link between the two was rarely established. A possible reason for this might be the nature of the concepts that formed the basis for the intervention. A theoretical construct such as reflection is rather ambiguous and perhaps difficult to concretize in practice. It can be perceived and discussed at what might be termed as a general, theoretical, or abstract level, but it is not easy to transfer it to concrete learning activities. Furthermore, there is a high risk of assuming a common understanding of a concept of this nature. A deep understanding — regarding theoretical aspects, the importance to students’ learning, and the intention of the study — was crucial to the success of the implementation. It is questionable whether there was actual consensus, between the teachers and me, on the details of reflection. Even though reflection was the object of attention and discussion in many situations and meetings, the fact that the teachers neither managed to include the reflection-related elements in the lessons, nor mentioned this omission in the evaluation, might be a sign that it had not been made adequately clear exactly what reflection entailed, how it might be implemented in practice, or how the students could be supported in their reflection process. Hence, an insufficient joint understanding, perhaps linked to their beliefs, may have been an obstacle for realizing our collaboratively-formulated intentions for the lesson. A more detailed and practice-related discussion of the concept of reflection, as well as an increased effort related to the professional development of the teachers (both during and in advance of the intervention), would very likely have been beneficial for the study.

According to Ernest (1989), there exist two key causes for the gap between espoused and enacted beliefs: the teachers’ level of consciousness of their own beliefs, and the influence of the social context. The latter may, for instance, influence the teachers’ beliefs through curricular restraints, systems of assessment, expectations of others (colleagues, students, parents, etc.), and educational traditions and culture. In the overall study, the teachers — expectedly —
often considered how the content of the intervention might meet the requirements for the final examination after 9th grade. They were also attentive to the expectations of the students, what the students were “used to”, or would think of as “real mathematics”. As a novice, teacher 1 was particularly influenced by expectations from parents, colleagues, and the school management. Teacher 2 might have felt certain expectations for her to be progressive or advanced in her teaching approach, being a mathematics counselor. For both teachers, the social context might thereby have controverted the intention of the intervention and thus impacted their decisions in the classroom.

Where teacher 1 was in the process of developing her beliefs about not only mathematics and mathematics education, but also about herself as a mathematics teacher, teacher 2 seemed to have strong and central beliefs in these areas. Still, the problem-solving view of mathematics that both teachers clearly expressed during our planning sessions did not always align with their teaching approaches in the classroom. A specific focus on their consciousness of their beliefs might have made them aware of such inconsistencies and perhaps had an impact on the alignment of the intended and the enacted intervention. However, the support strategy of the overall study did not include an explicit facilitation of the teachers’ consciousness of their own beliefs.

In addition, the support strategies were complicated by the allocation of expertise between the teachers and me as a researcher. A possible dilemma occurred when deviations from the intention, that were observed in the teaching, were to be addressed in the evaluation. It was, on one hand, essential to the success of the innovation that the intention was realized. On the other hand, the communication between me and the teachers must remain respectful of our respective areas of expertise while at the same time supporting and benefiting future cooperation and innovation. Addressing problematic issues related to practice thus became a difficult balancing act. In this case, the evaluation session led to adjustments in the support strategy that increased the explicitness of the innovation, thereby changing its attributes and affecting the level of the users’ autonomy. Studying the influential factors of this case clearly illustrates that the attributes and overall goal of this innovation may, to some extent, have been incompatible. The goal of developing the students’ beliefs through teaching principles may have demanded a change that was too ambitious in terms of the culture of practice — the influence of which was underestimated. For example, this case shows how the implementation of opportunities for reflection was hindered by a gap between the intentions of the researcher, the apparent intentions of the teachers, and what was practically possible within the context of the culture of practice and the teachers’ how-to knowledge.
Conclusion

Returning to the research question, it is clear that IR constructs do have something to offer this qualitative case study in terms of explanatory power about the lack of mutual understanding between researcher and teachers. The IR analysis made it clear that when an innovation is not specific or explicit enough, the implementation of it is proportionally dependent on the characteristics of the end-users. In this case, the teachers’ knowledge and beliefs became decisive for the realization of the intended intervention; and, due to the allocation of expertise, the support strategies were not always able to counter inconsistencies in this process. The analysis also reveals that the fundamental attributes of the innovation, such as the goal of the intervention as well as its fundamental theoretical concepts, might not have been compatible with the context. This study thereby points to the importance of considering and aligning multiple influential factors both in the design and in the support strategy of an innovation.

Hence, by studying a case of supposed miscommunication through the lenses of IR, it is certainly possible to gain a deeper understanding of the processes involved in changing practice through an intervention, as the analysis provided possible explanations for the discrepancy between intention and realization. It is a different and far more complicated matter to give suggestions or guidelines for how such discrepancy might be avoided. Still, I am convinced IR theory can make essential contributions in this regard when included in the design of an innovation.

Regarding the question of what qualitative, small-scale studies have to offer IR, this study illustrates how factors that might seem more or less insignificant or irrelevant may be highly influential in the implementation process. In this case, the difference between the two teachers’ level of experience was never considered problematic or even important to the success of the intervention. If anything, it was seen as an interesting variety, which could enrich the data collection in terms of a broader representation. However, the analysis revealed that this dissimilarity was an obstacle to the linking of theory and practice in the discussions between researcher and teachers — discussions that were essential to the realization of the intentions. Likewise, the case showed how the allocation of expertise affected the support strategies, possibly hindering a fulfillment of the purpose of these strategies. Issues of this kind can be crucial to an implementation process, but can primarily be investigated through context-including, small-scale studies, using qualitative methods. In this way, qualitative case studies of what happens when teachers are involved in implementation processes, and how different factors influence these processes, may contribute to a deeper understanding that is crucial to a successful
implementation of an innovation, regardless of the scaling ratio. Moreover, when scale is understood as a multidimensional concept, as by Coburn (2003), small-scale, qualitative studies may shed light on the processes connected to depth, sustainability, and shift in reform ownership. In the design of the overall intervention described here, the depth of the teachers’ understanding of the principles behind the intervention, as well as the intention to change more than the “surface” of their approach to teaching, were highly prioritized. Also, the teachers’ feeling of agency was ranked highly, partly with the hope of a shift in ownership. The IR analysis of this small case study shows, however, that other influential factors in the implementation process may have been hindrances. For a scaling-up of an implementation to be successful, a deep understanding of these processes and mechanisms is essential — an understanding that can only be achieved through small-scale, qualitative studies.

References


