

Editorial

Theoretical Framing as Justifying

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In our March editorial (Cai et al., 2019), we discussed the nature of significant research questions in mathematics education. We asserted that the choice of a suitable theoretical framework is critical to establishing the significance of a research question. In this editorial, we continue our series on high-quality research in mathematics education by elaborating on how a well-constructed theoretical framework strengthens a research study and the reporting of research for publication. In particular, we describe how the theoretical framework provides a connecting thread that ties together all of the parts of a research report into a coherent whole. Specifically, the theoretical framework should help (a) make the case for the purpose of a study and shape the literature review; (b) justify the study design and methods; and (c) focus and guide the reporting, interpretation, and discussion of results and their implications.

JRME reviewers frequently comment on theoretical frameworks in their evaluations of manuscripts. Our analysis of the reviews for every manuscript that underwent full review and received a decision in 2017 revealed that reviewers raised concerns related to the theoretical framework in nearly 90% of manuscripts that were ultimately rejected. Indeed, approximately 70% of the individual reviews for these manuscripts included concerns related to the theoretical framework. Even for those manuscripts that were ultimately accepted, nearly 30% of the individual reviews still raised such concerns. Common concerns expressed by reviewers included the following: that the manuscript lacks a sufficiently developed framework, that the framework is not appropriate, that the framework is overly broad or generic, that the framework is overly narrow or myopic, and that the framework is disconnected from the other parts of the study. Concerns like these often reflect serious issues with a manuscript that generally require significant revisions if these concerns are to be effectively addressed.

What Is a Theoretical Framework?

Much has been written about theoretical frameworks, and some researchers have explicitly called for increased attention to theoretical frameworks in mathematics education research (e.g., Leatham, in press; Lester, 2005; Silver & Herbst, 2004; Skott, Van Zoest, & Gellert, 2013; Spangler & Williams, in press). Despite these calls, the notion of a theoretical framework can remain somewhat mysterious and confusing for novice and experienced researchers alike. Moreover, novice researchers may mistakenly believe that a theoretical framework is merely a straightforward summary of related studies. We recognize that some researchers make an explicit distinction between theoretical frameworks and conceptual frameworks (e.g., Eisenhart, 1991; Imenda, 2014; Lester, 2005). However, these

terms have often been used interchangeably in the literature. In this editorial, we use the term *theoretical framework* broadly (similar to the treatment of conceptual frameworks by Eisenhart, 1991, and Lester, 2005) to encompass the set of assumptions, theories, hypotheses, and claims (as well as the relationships between them) that guide a researcher's thinking about the phenomenon being studied.

Researchers have used a number of different metaphors to describe theoretical frameworks. Maxwell (2005) referred to a theoretical framework as a "coat closet" that provides "places to 'hang' data, showing their relationship to other data," although he cautioned that "a theory that neatly organizes some data will leave other data disheveled and lying on the floor, with no place to put them" (p. 49). Lester (2005) referred to a framework as a "scaffold" (p. 458), and others have called it a "blueprint" (Grant & Osanloo, 2014). Eisenhart (1991) described the framework as a "skeletal structure of justification" (p. 209). Spangler and Williams (in press) highlighted this structural role of theoretical frameworks by drawing an analogy to the role that a house frame provides in preventing the house from collapsing in on itself. Each of these metaphors draws on notions of connection and structure for the purpose of organizing and supporting work. They portray the theoretical framework as something purposefully constructed from multiple components. It is not simply found or chosen—ready-made, say, by searching the literature—nor can it be so generic that it provides little guidance for conducting the study or writing a report.

We take a strong position that, to be useful, the theoretical framework should be constructed by the researcher as a critical part of conceptualizing and carrying out the research. To this point, as one *JRME* reviewer explained, "It is not enough to use definitions that appear in the literature to provide a theoretical grounding."¹ One must do more than simply present an assemblage of existing parts from the literature. Even when using existing theories and frameworks, researchers must explain how they draw upon and combine them to build a framework that is suited to the present study.

In particular, we believe that a theoretical framework for a study is constructed through and for justification. It is constructed *through* justification when researchers ask themselves a series of questions as they conceptualize and conduct their studies: Why is this topic an important thing to study? What do I expect to find? What do I think the answers to my research questions will be? Why do I expect those findings? This last question often leads to a first-level set of general reasons like "because students won't understand the tasks well enough to score well" or "because instruction will not be sustained long enough" and so on. Then, by justifying their answers to this question—asking themselves why these are good reasons—researchers can develop a second-level set of reasons (like "if the task is not in students' zone of proximal development, they are unlikely to understand it") that begins producing hypotheses that are connected with previous research. These connections between what is new and what is known form the basis of a theoretical framework that guides the selection of research questions, research methods, and data collections and that supports compelling explanations of the findings that can move the field forward. In this way, the theoretical framework can, for example,

¹ All reviewer comments in this editorial have been paraphrased to respect the confidentiality of the review process.

ensure that a study provides new information addressing teachers' shared instructional problems and helps the field (students, teachers, policy makers, researchers) understand why and how the results will help solve those problems.

The theoretical framework is also constructed *for* justification and, in particular, for explaining to others the reasoning that underlies the decisions made in a research study. Although we recognize that the theoretical framework guides the conceptualization and conduct of a research study, below we primarily focus on the role of the theoretical framework in communicating research to the wider mathematics education research community. At minimum, the theoretical framework must support three kinds of justifications in the report: the *why* (the purpose of the study), the *how* (the methodology of the study), and the *what* (the discussion of the study's findings and their implications).

These components of justification are interconnected, link by link, into a larger, coherent chain of reasoning that permeates the report and holds it together. A missing or broken link obscures the logic of the study, making it seem incoherent. As one *JRME* reviewer put it, "The research design lacks coherence because of the lack of coordination among the frameworks used; this makes the methods seem disconnected from both the question and the findings in the discussion."

The Why: Justifying the Purpose of the Study and the Scope of the Literature Review

"The authors introduce many frameworks and constructs in the theoretical framework and the literature review. However, it is not clear which one will be the focus."—A *JRME* reviewer

As we discussed in our March editorial (Cai et al., 2019), significant research questions—ones that extend the field's knowledge—rely "on a chain of justification forged from a theoretical framework that draws on the knowledge of the field" (p. 118). Research studies are built on a foundation of knowledge developed through earlier work, both theoretical and empirical. "Through a research question's connections to prior research, it should be clear how answering the question extends the field's knowledge because it is based on hypotheses suggested by previous research" (Cai et al., 2019, p. 118), hypotheses that we refer to as *educated hypotheses*. These educated hypotheses, stemming from the review of the literature, allow readers to anticipate the possible findings and potential contribution of the work. When authors do not clearly present the theoretical framework that connects the study to earlier work, they give readers (and reviewers) the impression that the study exists in a vacuum. More precisely, readers are left guessing how it advances the field's understanding of mathematics teaching and learning.

By laying out the theoretical framework, researchers situate their perspectives and their research questions in the broader field.² During the conceptualization

² A key consideration for authors preparing a manuscript for *JRME* is that the journal is focused on mathematics education research. Thus, although the journal does not prescribe a set of theoretical frameworks specific to the domain of mathematics education, it remains extremely important to draw connections between the theoretical framework that has been employed and relevant theories about the teaching and learning of mathematics. This is particularly important in cases where research has been conducted in a different, but related, domain (e.g., cognitive science, educational psychology, and so forth).

and conduct of a research study, this means that researchers make explicit for themselves how their research questions are similar to and different from related questions already studied by other researchers. They construct and refine the theoretical framework to better understand and analyze the phenomenon being studied and to decide what to read and look for in prior research (e.g., peripheral areas versus areas where the researcher needs to be an expert). When preparing a research report, this means that the scope of the literature review—what counts as relevant to this particular study—is justified by the theoretical framework that has been constructed over the course of the study. Because the theoretical framework provides a connected set of reasons for the decisions made in conducting the study, only the previous research that made a difference in those decisions is essential to include in the literature review.

Reviewers will often suggest additional literature to review. However, the researcher must still carefully consider what prior research is truly relevant. The literature review should not become a laundry list of relevant research (although it may seem tempting to take this approach in response to reviewers' calls to include additional literature). Rather, it should draw on the theoretical framework to organize the literature in a useful, and perhaps novel, way that justifies why the contribution of the particular study is significant. When a reviewer raises the concern that the researcher failed to review a relevant study or line of research, this may mean that the study is not properly positioned with respect to what is already known. In other words, if a reviewer chooses to raise this kind of concern, it should be because the reviewer believes that if the omitted literature had been taken seriously, the researcher would have made different decisions and would have conducted the study or interpreted the findings differently.

The How: Justifying the Design of the Study and the Research Methodology

"A number of critical methodological choices were not well justified, and I wanted to know more about the theoretical support for those choices."—A JRME reviewer

In any research study, a variety of methods and approaches can be used to answer the research questions. A theoretical framework, even one that is still being developed over the course of a study, helps provide the researcher with reasons for making particular methodological choices. As Mason (2005) pointed out, frameworks

inform the researcher in the design of their study, such as when seeking tasks to reveal dimensions of variation of which subjects are aware or can access, to get them doing and talking as well as making records, to provoke them into displaying mathematical thinking and to stimulate them to expose the subtle shifts in the structure of their attention. (p. 18)

In the reporting of a research study, the theoretical framework therefore helps justify for readers why the chosen design for the study makes sense to answer the research questions. It should be clear from the theoretical framework how the methods chosen for the study will lead to collecting data that will address the research questions. Simply stating the choice of a particular methodology is not

justification enough. The researcher must make an argument, based on the theoretical framework, to motivate the choices made for the design of the study, the methods of analysis, and so on.

The theoretical framework helps researchers make decisions about the choice of methods in multiple ways. For example, a researcher who is studying questions about teaching mathematical proof recognizes that sociomathematical norms have been used to explain how what counts as a valid proof or mode of proof is socially negotiated in classrooms. So, the researcher includes sociomathematical norms as part of the theoretical framework of the study. Because these norms are negotiated through discourse and argumentation in the classroom, the researcher also includes the theoretical machinery of discourse analysis, including Toulmin's model of argumentation. These decisions prompt the researcher to include observations of socially negotiated products during class discussion to capture activity that might contribute to the classroom development of proof. In turn, these choices in constructing the theoretical framework motivate and justify the researcher's choice of techniques for data collection (e.g., video-recording discourse in the classroom) and data analysis.

In contrast, if there is a mismatch or a lack of connection between the theoretical framework and the methodological choices, readers and reviewers may rightfully question the validity of the instruments and the analysis. For example, the constant comparison method and building grounded theory (Corbin & Strauss, 1990) are frequently cited somewhat loosely as methodological (and theoretical) choices (Mewborn, 2005). Reviewers become concerned when a research report refers to grounded theory without any indication of how this influenced the decisions that were made to conduct or report the study. Reviewers also raise concerns when a research report invokes this methodology but also describes a detailed and highly specified theoretical framework that would preempt the development of a grounded theory. Lack of connections or contradictions like these between the theoretical framework and methodological choices ultimately weaken the contribution of a report of research.

The What and the So What: Justifying the Presentation of the Findings and the Interpretation of the Findings

“Because this manuscript is missing a theoretical framework, the discussion lacks support, and it is impossible to judge the merit of the findings.”—A JRME reviewer

Thus far, we have made the case that a study should be guided by educated hypotheses and a justified methodological design. With these two components in place, the findings of a study will emerge from data that address the research questions and confirm or disconfirm the hypotheses. Interpreting the findings can then take the form of comparing theoretically grounded predictions to actual results and then refining or extending the theoretical framework to support revised hypotheses that align with what was actually observed. The revised framework can be presented as the study's contribution to the field, and the new, more educated hypotheses can be tested in future studies. In contrast, if the study is not situated within clearly justified hypotheses, the findings are not anchored to their intended purpose, and researchers can be tempted to make overreaching claims.

The theoretical framework also provides context for the discussion of the findings. As a vital connection between the findings that have been presented and the larger argument that is made, the theoretical framework gives the researcher a mechanism to explain how the findings address and answer (or fail to answer) the research questions. For example, in a quantitative study there may be many results that are statistically significant. It is incumbent on the researcher to use those results to justify which of the educated hypotheses have or have not been confirmed. More broadly, the theoretical framework, having already been used to establish the relevance of the study to the field, is key to explaining to readers the new contribution of the findings. In short, the discussion of the findings should revisit the educated hypotheses that emerged from the review of the literature, demonstrating the significance of the findings that result from the present study in light of that other work and informing refinements to the theoretical framework.

Conclusion

Too frequently, we find *JRME* reviewers lamenting that the theoretical framework is insufficiently developed and disconnected from the rest of the manuscript (e.g., “the theoretical framework and methodology are not congruent” and “the theoretical framework is only arbitrarily connected to the data”). Indeed, more than one quarter of the reviews for rejected manuscripts in 2017 included such comments. We believe that a well-constructed theoretical framework comes from researchers’ careful thinking about the reasons—the justification—for the hypotheses they formulate about the likely outcomes of the study. The framework is then used to guide the choice of literature reviewed, the research methods applied, and the claims of significance and contribution to the field. The theoretical framework thus ties together the background, methodology, and findings of a study into a single cohesive narrative.

In our next editorial (July 2019), we will focus on choosing methods for conducting a study and describing these methods in a report of the study. We will argue that research questions dictate the choice of research methods; the theoretical framework helps researchers choose the methods that will generate the kind of data needed to address the research questions. But researchers still must make decisions among a variety of methods that could be used. How do researchers make these decisions? To develop our argument, we will again point out common errors in choosing methods and describing them.

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