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Towards a Theory of Mathematics Teacher Learning Ecologies

Nadav Ehrenfeld, Vanderbilt University, nadav.ehrenfeld@vanderbilt.edu

Abstract: Research on mathematics teachers' learning typically focuses on single activities or programs and does not acknowledge the interactive impacts of multiple experiences in different settings. In contrast, from a teacher perspective, teacher learning happens across time and settings, through a complex web of learning experiences. In this conceptual paper, I propose how we could extend interactionist approaches to include a systems-level lens, towards a theory of teacher learning ecologies.

Introduction and purpose

The main premise of this paper is that teacher learning happens across time, settings, and activities (Borko, 2004; Clarke & Hollingsworth, 2002; Horn et al., 2013). While these ideas are not new, they have not yet been worked into theories and designs for teacher learning. Consequently, as a field, we seldom study and design teacher learning across the multiple sites of its development. In a review of 106 research studies about mathematics teacher learning, Goldsmith et al. (2014) claimed that none of the studies "prospectively laid out an iterative, multidomain theory of action for the intervention" (Goldsmith et al., 2014, p. 20). This is a problem, because employing simplistic conceptualizations of teacher professional learning limits our ability to explain — and consequently to support — different paths for such learning (Clarke & Hollingsworth, 2002; Opfer & Pedder, 2011). With this discrepancy in mind, rather than describing a certain activity, or certain features of activity, as optimal for teacher learning, the goal of this study is to work towards a more holistic conceptualization that highlights possible relationships between learning processes, settings, and activities. My point is neither to diminish the value of research on the effects of specific activities (or certain features of activities) on teacher learning, nor to claim that every study of teacher learning must include all possible aspects of teachers' learning ecologies. Rather, I claim that (1) attempts to look at subsystems must be understood as partial (Opfer & Pedder, 2011) and (2) employing more complex theories of teacher professional learning would extend our ability to explain and consequently to support teachers (Clarke & Hollingsworth, 2002). The goal of this paper is to work toward such conceptualization.

Extending interactionist perspectives to include system-level analysis

Research on teacher learning in math education tends to focus on the effect of PD interventions, where learning itself is not the main object of study but rather an indicator of the effectiveness of specific curricula, programs, or features of activity (Goldsmith et al., 2014). Interactionist perspectives on teacher learning break out of these constraints and privilege context, complexity, interactions, and questions such as why, how, what, and under what conditions teachers learn. At the center of interactionist perspectives on teacher learning is the sociocultural notion that learning is social and talk plays a main role in learning processes (Horn & Bannister, 2020). Interactionist researchers operationalize learning in a variety of ways: They detect specific learning moments within meetings; follow processes of collaborative and individual meaning-making and knowledge construction; and underscore conditions that are productive for learning (Lefstein et al., 2020). More generally, learning is mostly seen through changes in discourse in the immediate PD setting. Less prominent in interactionist perspectives is explicit attention to accounts of learning that are distributed across settings as part of participation in a broad range of activities, more and less formally structured (for exceptions, see Ehrenfeld et al., 2020; Horn et al., 2013). For example, in their review, Lefstein et al. (2020) noted that researchers in this field rarely attend to broader contexts of teacher conversations; "rather, they primarily focus on the immediate context of the setting or intervention" (p. 6). Accordingly, I argue that studies that take an interactionist perspective of teacher learning typically make rich connections between learning and its immediate contexts, but pay less attention to connections among different settings and activities teachers participate in. My approach in this paper is to extend interactionist approaches to include system-level analysis. That is, I suggest that to fully realize the affordances of interactionist theories for teacher learning, we need stronger theoretical connections between different scales where such learning takes place (see Figure 1).

The claim that we need stronger theoretical connections between the immediate and larger contexts of teacher learning reflects more general calls in the Learning Sciences. One such example comes from the recently published Handbook of the Cultural Foundations of Learning, wherein Nasir et al. (2020) conceptualize learning as "occurring along culturally organized learning pathways—sequences of consequential participations and transitions in learning activities that move (or do not move) one towards greater social recognition as competent in particular learning domains and situations" (p. 195). Nasir et al. made the overall claim that focusing only on

local learning interactions limits our understanding of the cultural, relational, affective, and contextual nature of learning and their intersections with systems of power. I build on this example and other system-level models for learning to start imagining directions for theorizing teacher learning ecologies. Specifically, I recognize different forms of system-level learning as possible directions of research that would potentially explicate mechanisms of learning across settings, where teachers' practices shift over time.

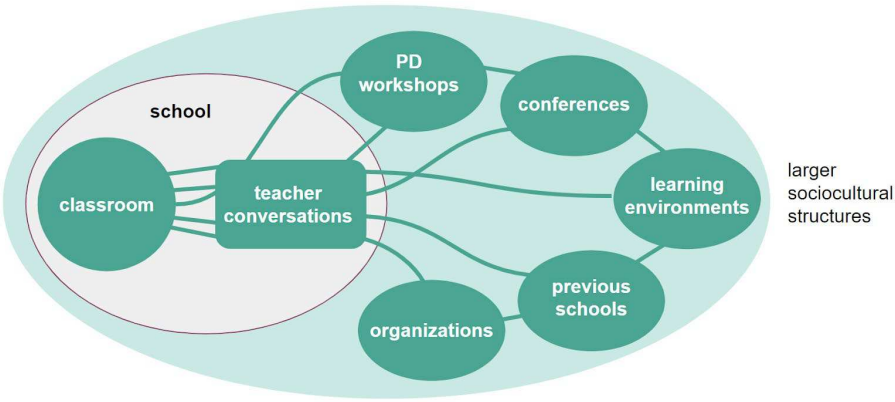

Figure 1. Suggested scope of an ecological perspective on teacher learning.

Significance

To support mathematics teachers, it is critical to understand how teachers learn across settings and to characterize the patterns of such processes (Borko, 2004; Horn et al., 2013; Opfer and Pedder, 2011). Interactional programs of research offer strong connections between learning and the immediate teaching context. Yet, these studies are typically bounded in specific activities and overlook broader learning contexts. I suggest extending interactional perspectives to encompass system-level analysis of learning. Such a perspective would open new spaces for thinking about, seeing, and designing for ecological teacher learning.

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