Studying the Process of Instructional Improvement Through the Lenses of Sense-Making Repertoires and Improvement Practices

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Although large numbers of educational reforms and innovations have been developed in the previous four decades, there has been relatively little change in instruction that happens in classrooms (Rowan, 2002). As a result, researchers have suggested that in order to bring about educational change, focus should be placed on the process of implementation and improvement, not just the development and testing of reforms (Bryk, Gomez, Grunow, & LeMahieu, 2015; Penuel, Fishman, Cheng, & Sabelli, 2011). These perspectives underscore the importance of examining the processes of teacher learning, instructional improvement, capacity-building, and organizational change across educational systems. Additionally, they highlight the potentially transformative power this focus can bring by studying designs for these systems-level goals.

My research broadly focuses on the process of instructional improvement in mathematics and science. I take both an observational and design-based approach to better understand and support teachers to productively engage in improvement, as well as support this improvement across educational systems. Additionally, my work encompasses processes at different time scales (e.g. micro- and macro-level instructional improvement), as well as processes that cross different contexts and actors (e.g. individual teacher learning, instructional coaching, administrator support). I bring two complementary perspectives to this work, (a) sense-making repertoires and (b) improvement practices, and consider both in interaction with tools and structures in educational systems. These two perspectives foreground the process of instructional improvements rather than the inputs and outputs of the process, and therefore, lead to new and different implications for designs that support teacher learning and instructional improvement.

Although I aim to understand processes of instructional improvement generally, I am particularly interested in improvements that promote equity and are deeply responsive to students as thinkers. Ideally, I hope my work can better enable teachers to empower students to be agents of change in their world through STEM. Therefore, my research has focused on teaching that is responsive to the disciplinary substance of student ideas (Hammer, Goldberg, & Fargason, 2012; Robertson, Scherr, & Hammer, 2015) and I plan to explore culturally-responsive dimensions of teaching (Ladson-Billings, 2014) and teaching that is responsive to classroom power dynamics (Hand, 2012).

Learning through teaching: The process of using everyday classroom experiences to improve teaching

My dissertation examined the way that secondary math teachers, primarily working with students from non-dominant communities, use their everyday classroom experiences to improve how they build on the substance of student mathematical ideas in their teaching. Therefore, this study focused on the process of individual teacher instructional improvement toward responsive teaching using the lens of teacher noticing (M. G. Sherin, Jacobs, & Philipp, 2011) for improvement. To examine this process, I conducted longitudinal point-of-view (POV) observations (B. L. Sherin & Sherin, 2010; M. G. Sherin, Russ, & Colestock, 2011; M. G. Sherin, Russ, Sherin, & Colestock, 2008) to access teachers' in-the-moment noticing for instructional improvement. During the observations, teachers collected video during a lesson from their own perspective using a wearable camera in the midst of teaching and used a remote to mark moments they thought would influence their efforts to improve their teaching. Shortly after the lesson, I interviewed teachers about the captured moments to uncover their in-the-moment cognition and how they planned to change their teaching based on their sense-making of the experiences. In addition to the longitudinal POV observations, I conducted design-based research around video-based professional development aimed at supporting teachers to develop responsive teaching practices based on the analyses of the longitudinal data. This research has begun to identify the sense-making repertoires and improvement practices used by teachers during the everyday processes of instructional improvement.

Sense-making repertoires

The focus on sense-making repertoires takes a more cognitive perspective on instructional improvement to analyze the common reasoning teachers use to improve their teaching, and in this case focused on reasoning used with everyday classroom experiences. This work found that one type of reasoning was particularly common and important during the improvement process: *causal reasoning about students*. When teachers use causal reasoning about students, they explain why events relating to students unfold the way they do (or will/did in the future/past), which I claim reflects the complex causal models teachers create (Dyer & Kaliski, 2016). I

also found that teachers used particular kinds of causal reasoning when they proposed changes to their teaching aligned with responsive teaching, suggesting that the type of causal reasoning can align with the type of improvement they propose to their teaching (Dyer, 2018). These findings question whether evaluation, another sense-making repertoire that is commonly underlies many models for instructional improvement, is in fact supportive of instructional improvement. While evaluation would highlight he importance of determining what worked or didn't work, the causal reasoning repertoire suggests that it may be most importance to consider why or how this work or don't work. As such, supports for teacher learning should enable teachers to be more analytical, possibly by eliciting and developing particular kinds of causal reasoning, rather than simply evaluating or describing teaching and learning. Specifically, in the case of practice-based teacher education (Ball & Cohen, 1999), these findings suggest that teachers need access to artifacts that provide evidence of the factors that influence student thinking or other outcomes, not just rich records of student thinking.

Improvement practices

Using a complementary perspective, my work has identified several improvement practices teachers engage in when using their everyday classroom experiences to improve their teaching, which often focused on positive classroom experiences. For example, one such method was *making infrequent successes more typical* (Dyer, 2017). In this method, a teacher notices a surprising, but positive event, such as a student making connections between ideas the teacher did not anticipate. The teacher then works to unpack what led to this positive, but isolated, event, and come up with a may to make it more typical. This improvement practice, as well as other that focus on positive classroom experiences, highlight how teacher improvement is not only a process to fix negative outcomes, as it is commonly framed in much of the models of instructional improvement. Instead, positive experiences can be important contexts for teacher improvement, leading to strengths-based approaches to instructional improvement instead of deficit perspectives that "fix" students or teaching practice (Dyer, 2017).

An ecological approach to instructional improvement

Previous work completed in the Learning Through Teaching project has highlighted the usefulness of the perspectives of sense-making repertoires and improvement practices for understanding the phenomenon of instructional improvement. Additionally, it has begun to identify specific types of sense-making repertoires and improvement practices, such as causal reasoning about students and making infrequent successes more typical. In future work, I plan to continue to identify additional types, leading to analytic frameworks to characterize the sense-making repertoires and improvement practices used by teachers and others. An important aspect of this future work would be to expand the contexts in which each of these perspectives are considered beyond the individual process of using everyday classroom experiences to improve teaching. Therefore I plan to examine data of formal professional development, instructional coaching, teacher collaborative work time, teacher evaluation, and informal conversations with other teachers. Most likely, different sense-making repertoires and improvement practices will be identified in these contexts, and the previously-identified methods may be used in different ways. As such, this work builds the foundation for an ecological, cross-context, theory for the process of instructional improvement.

An educational systems approach to instructional improvement

In addition to focusing on teachers when studying instructional improvement, the educational systems teachers are a part of are an important complementary perspective (Cobb & Smith, 2008; Coburn, 2016). In particular, I aim to study support for instructional improvement the meso-level actors and structures at the school, district, and regional levels in conjunction with teachers, who can be represented as micro-level instructional improvement actors. In my post-doctoral and current work, I study instructional improvement at a systems-level through partnership work with school districts that aim to support science and math teacher instructional improvement. These projects have worked in partnership with districts to develop supports and programs, such as teacher leader roles and teacher professional development programs, using methodologies such as design-based implementation research. Through this work and future work, I am to develop theories for sustainably supporting instructional improvement through capacity building and organizational change. In addition to studying how these meso-level actors make sense of and design structures to support teachers' sense-making repertoires and improvement practices, this work will explore the sense-making repertoires and improvement practices used in capacity-building in educational systems.

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