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Advancing a Democratic Pedagogy and Supervision Framework: An Illustrative Case of Teacher Questioning in Secondary Mathematics Instruction

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Conceptual

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Abstract

This article pushes back against the *evalu-centric view of improvement* (Hazi, 2018; 2020) in the supervision literature by advocating for a democratic pedagogy and supervision framework developed to support instructional supervision and evaluation dialogue between teachers and leaders. This democratized approach honors and centers the teacher's expertise and learning as well as the leader's in the observation, debrief, and reflection process. Through this decentering of expertise in the instructional supervision cycle, our goal is to build leaders' and teachers' mutual capacity to develop, implement, and sustain democratic instructional supervision cultures in classrooms and schools. Additionally, we illustrate our framework through a subject/discipline-specific case of instructional supervision in secondary mathematics instruction. Through this illustrative case, we demonstrate how the framework provides school leaders and teachers with specific, shared pedagogical language to engage in standards-based mathematical dialogue during the instructional supervision process. Finally, we discuss the implications of our questioning framework for democratic school leadership, supervisors' leadership content knowledge, teachers' discipline-specific work of teaching, and instructional supervision practices, which are often stifled by accountability-driven teacher evaluation education policies that suppress schools' leadership capacity to apply democratic instructional supervision standards and principles.

Keywords

democratic leadership; instructional supervision; mathematics teaching; questioning practices; instructional leadership

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Introduction

Research has long documented a relationship between the instructional supervision of teachers and the academic performance of students (e.g., Blase & Blase, 2003; Cotton, 2003). The feedback school leaders give teachers in instructional supervision is critical to supporting teachers' professional learning, providing evidence which teachers can utilize to track and improve their practice (DiPaola & Hoy 2014). In an essay on instructional improvement, Hazi (2018; 2020) points out that the long-held *evalu-centric view of improvement*, centered around the evaluator or the evaluation instrument, makes the erroneous assumption that the evaluator or the instrument should identify effective teaching and areas for improvement. According to Hazi, this makes the teacher the passive recipient of feedback that might or might not be calibrated to their specific instructional context (e.g., current students, subject area, grade level, etc.). Hazi (2020) warns that this approach makes knowledge "external to teachers, remote and delivered" (p. 97) and works counter to teachers' need for a more inquiry-based stance that would support sustained teacher learning (Yendol Hoppey et al., 2019). Hazi (2020, p. 97) names four challenges facing instructional supervision:

1. a reductionist view of teaching
2. a behaviorist orientation to changing teachers
3. an emphasis on uniformity
4. a process-product lens for measuring improvement

This article pushes back against the *evalu-centric view of improvement* (Hazi, 2018; 2020) in the supervision literature by advocating for a democratic pedagogy and supervision framework developed to support instructional supervision and evaluation dialogue between teachers and leaders. This democratized approach honors and centers the teacher's expertise and learning as well as the leader's in the observation, debrief, and reflection process.

In alignment with Hazi's (2020) call to move beyond an *evalu-centric view of improvement* towards a sustained teacher learning approach, the consensus of researchers is that instructional feedback can promote teacher growth if the feedback contains three qualities: a) based on observable data, b) includes specific characteristics of effective teaching, and c) promotes reflective inquiry on how instruction impacts student learning (Feeney, 2007). Furthermore, the democratic supervision literature also has a long history but continues to be conceptual in scope and content (Glanz & Hazi, 2019; Glickman et al., 2018; Gordon, 2016). Scholars have argued that the principles of democratic leadership enhance the effectiveness of instructional supervision (Ärlestig, 2008; Gordon, 2016; Ylimaki & Jacobson, 2013); however, there is scant empirical evidence that identifies, describes, or establishes the efficacy of democratic instructional supervision processes in actual school practice (Glanz & Hazi, 2019). We argue that one reason for this research and practice gap is that democratic supervision scholarship has neglected content-based pedagogy, inquiry, and dialogue among leaders, teachers, and students as an essential component to developing democratic cultures. Any attempt to develop democratic supervision cultures and processes without a focus on the language of and dialogue about content and pedagogy will ultimately fall short.

The purpose of this article is to advance a democratically structured model of supervision calibrated to build professional learning capacity that honors, not just the leaders' expertise, but also the teachers' expertise and students' inquiry and learning within respective disciplinary areas of content and pedagogy. Drawing from existing literature, we have created the Democratic Pedagogy and Supervision Framework (DPSF) which is composed of four main dimensions: 1) the work of teaching, 2) leadership content knowledge, 3) student dialogue about content, and 4) building capacity to implement democratic instructional supervision. Together, we assert that these dimensions form the learning foundation of a democratic learning community and the organizational capacity to enact democratic instructional supervision.

This framework is a significant contribution to research about and the practice of democratic supervision for several reasons. First, the DPSF prioritizes the need for principals and teachers to share common, accessible language focused on indicators of content pedagogy and student engagement. Second, the DPSF supports standards-based, content-focused, and evidence-based pedagogical dialogue between principals and content-area teachers. Third, the DPSF prompts leaders and teachers to engage in pedagogical dialogue as a basis of egalitarian professional relationships focused on student inquiry and learning in discipline-specific ways. Finally, the DPSF grounds democratic leadership principles and supervision practices to the ecology of inquiry and dialogue shared among leaders, teachers, and students.

This article is organized into five parts. First, we define and portray democratic supervision as an ecological model of pedagogical practice and student learning. Second, we expand this ecology of practice to identify and define the DPSF across four dimensions of pedagogical activity, inquiry, and dialogue expressed among leaders, teachers, and students. Third, we illustrate and apply how a case of secondary mathematics questioning represents a classroom-level model for establishing schoolwide democratic supervisory practices across multiple disciplines. Fourth, we discuss the foundational scholarship which informs the DPSF, describing mathematics questioning as a discipline-specific and pedagogical practice to build democratic supervision capacity. Finally, we make concluding remarks and provide recommendations for future scholarship and practice.

Literature Review

We define democratic instructional supervision as a relationship among professional equals, where leaders and teachers provide reciprocal pedagogical support aimed to improve students' learning experiences and outcomes (Glanz & Hazi, 2019; Waite, 1995). Embedded within the established democratic leadership school culture, Gordon and Boone (2014) described democratic instructional supervision cultures as a form of "collectivist instructional leadership," which enables all stakeholders to participate fully in instructional supervision and increase a school's capacity for instructional improvement (p. 27). Relationally, building capacity for a democratic supervisory school culture requires leaders and teachers who mutually engage in democratic instructional supervision at the classroom level, "[where] classroom observations provide a joint starting point and frame for conversations between the principal and the teacher about the interactions between the teacher and the students" (Ärlestig & Törnsen, 2014, p. 857). This decentering of expertise, moving from a leader as the expert to a recognition of expertise

each professional brings to the instructional supervision process, is a foundational component of our democratic vision of instructional supervision.

Yet, why should we work to decentralize expertise and further democratize school leadership and instructional supervision? Steinbacher-Reed and Rotella (2017) argue for a professional *sandbox* approach to advance school leader and teacher collaboration to improve student learning outcomes. They recognize that leaders and teachers share some understandings about instruction, but they do not always share a deep understanding and appreciation of the differences between their roles. Steinbacher-Reed and Rotella claim,

> When educators move into administrative roles, they can quickly lose sight of what it's like to be in the classroom. They rarely have the chance to deepen their understanding of current practices. Over time, they become further removed from the work of instruction. Meanwhile, exceptional classroom teachers are becoming experts in the latest teaching practices, but they often lack the skills or opportunities to lead capacity-building efforts in their schools. These opposing trajectories create a wall that has traditionally divided teaching and leading—with administrators and teachers unable to fully view one another's practices. (p. 68)

Steinbacher-Reed and Rotella are only highlighting some of the differences in roles and expertise that could exist between instructional leaders and teachers. Teachers, specifically, have other forms of expertise depending on the context, which may include (but is not limited to) expertise in discipline or subject matter, grade level, specific student populations, intervention strategies, language, and culture. We focus on teacher expertise in our argument since teachers are less likely to be positioned as experts in a supervisory relationship than the professionals being supervised. Yet, we argue that these differences in roles, and associated challenges, can be leveraged as strengths when we restructure the instructional supervision process and honor those differences in expertise, especially those of teachers.

The Ecology of Democratic Supervision within Content and Pedagogy

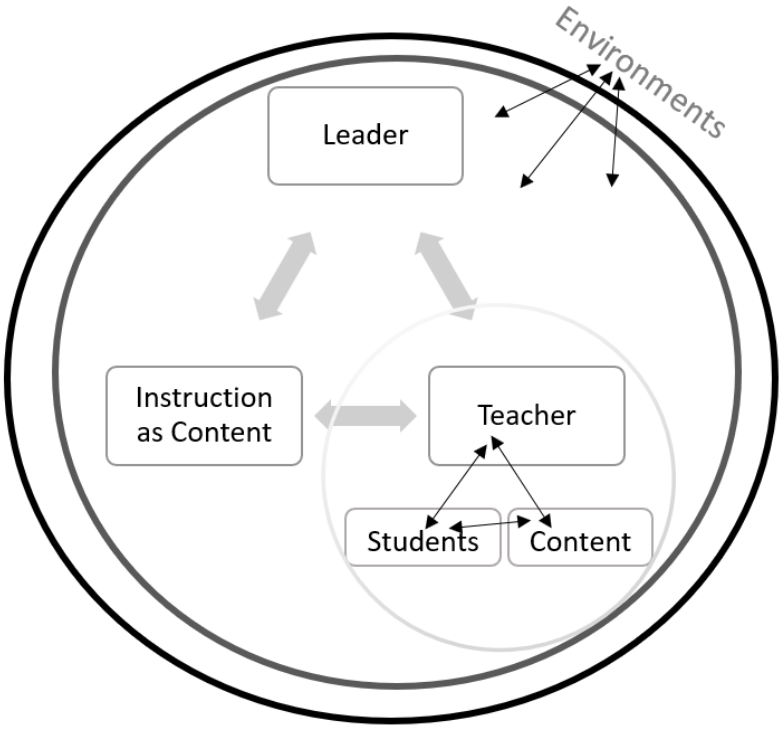
Here, we present the underlying ecological model for pedagogy and supervision (Figure 1). This adapted model asserts that the content-centered dialogic exchanges between and among students, teachers, and leaders serve as the basis of democratic instructional cultures. To create our ecological model for democratic pedagogy and supervision (Figure 1), we adapted the instructional triangle of Cohen et al. (2003), because as a conceptual framework, it is ecological in nature, which allowed us to represent the complexity of pedagogy and supervision in relation to contextual environments.

In the original instructional triangle (Cohen et al., 2003), webs of interaction are represented by bi-directional arrows, which when diagramed form a triangle connecting the teacher, students, and instructional content. This triangle of interactions takes place within multiple concentric circles depicting the layers of environments that are external to instruction (e.g., a school context, a state socio-political environment, structural racism in a school system, etc.). The interactions between the broader socio-cultural and political environments and the instructional triangle are also depicted through bi-directional arrows. In other terms, the environments enter the

instructional space through the teacher, students, and content, and in turn, the teacher, students, and content impact the broader environments outside of instruction too. We argue that the instructional moves or practices the teacher makes, in particular, the questions teachers ask students, rest on those arrows. To illustrate, a teacher posing a subject-based question (e.g., mathematics – What strategy would you use to solve this problem?) would originate from the teacher, follow the arrows through the content to the student; whereas, a relational question (e.g., how are you feeling today?) would travel on the arrow directly between the teacher and student without going through the content.

In Figure 1, we adapted the instructional triangle to depict instructional supervision as an instructional scenario in which professional learning occurs. As such, we recreated the triangle showing the instructional leader, teacher, and professional learning content as the three points of the triangle embedded in the larger environments. We also embedded the original instructional triangle (Cohen et al., 2003) in the supervision model, showing that the instruction at the core of the instructional supervision process is mediated by the teacher. For our uses, the instructional triangle is general enough to represent instructional interactions without committing us to a specific subject area, grade level, sociopolitical context, or other such limitations. We felt this dexterity is particularly important to our adaptation of this model given the expanding use of instructional supervision across early childhood, K-12, and postsecondary contexts. Moreover, we wanted our framework to show the complexity of the relationships across instructional leadership, teaching, and the content of professional learning in instructional supervision within supervision's larger environments, such as state policy contexts, as the instructional triangle was designed to illustrate.

Figure 1.
A conceptual, ecological model for democratic instructional supervision adapted from David Cohen and colleagues' (2003) Instructional Triangle.



Integrated into the ecological model, we merge elements of the larger umbrella of democratic leadership, which we conceptualize as an environmental, cultural, and systemic developmental process. We operate under the assumption that democratic school culture is represented as part of the school community's vision and mission and is consistently and systematically evaluated. Following Furman and Starratt (2002), we define a democratic school community, where a leader fosters an environment where: "1) community is based on open inquiry, 2) community members work for the common good, 3) the rights of all, including the less powerful, are respected, and 4) creating democratic community in schools is [approached as] a systematic challenge, involving structures, processes and curriculum" (p. 106). It is critical to include each of the main school actors in any discussion or construction of democratic supervisory practice models, specifically students, teachers, and leaders. The supervisory process does not exist in a vacuum and is subject to many influences, both internal and external to the school community.

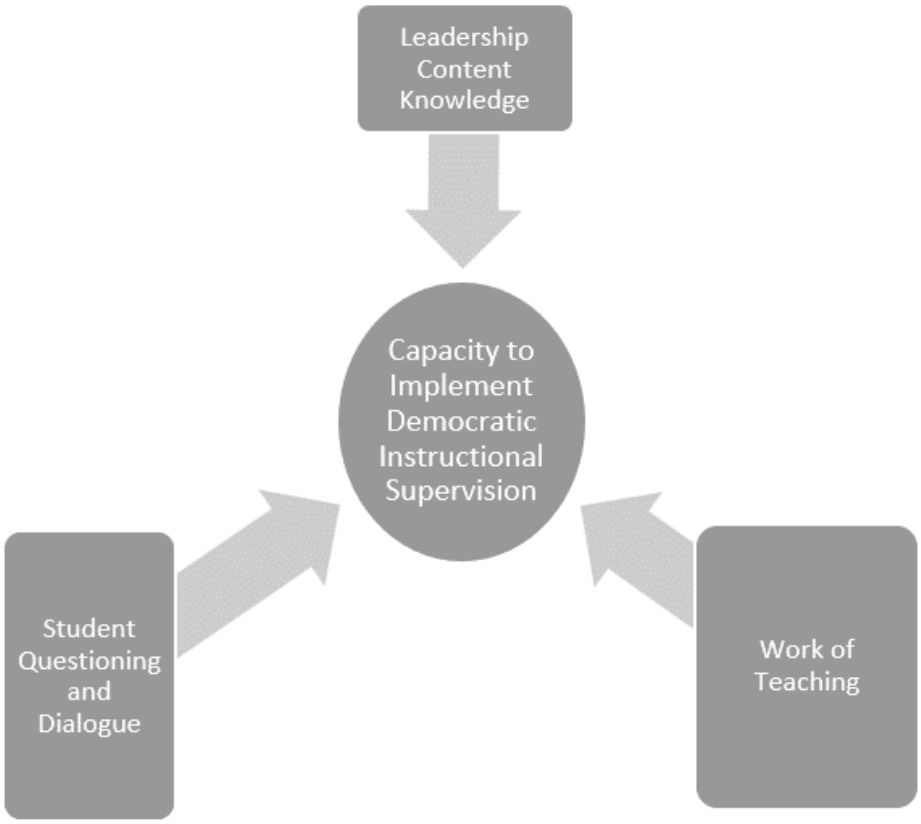
Faced with internal and external threats to democratic leadership aspirations, the extent to which democratic supervision can be integrated locally relies upon principals' and teachers' mutual capacity to engage in a specific, collaborative content area and pedagogical dialogue (Glickman et al., 2018; Gordon & Boone, 2014; Jimerson & Fuentes, 2019; Mallory & Reavis, 2007; Zepeda & Mayers, 2014). We agree that "pedagogy is the observable act of teaching together with its attendant discourse of educational theories, values, evidence, and justifications. It is what one needs to know, and the skills one needs to command, to make and justify the many different kinds of decisions of which teaching is constituted" (Alexander, 2009, p. 5). It is within this broader ecological space that we focus more closely on the instructional supervision process, which comprises a subarea of leadership and practice that can have a significant impact on student learning. In particular, we intend for the DPSF to advance the democratization of instructional supervision conferences, evidenced to be a key part of the instructional supervision process (Zepeda & Mayers, 2014).

The Four Dimensions of the Democratic Pedagogy and Supervision Framework

Drawing from our definitions of democratic supervision and the ecology of pedagogical practices, we identify and define the four dimensions of the DPSF. The foundation of each democratic supervisory framework dimension is anchored in dialogue about the content. This dialogue is shared among teachers, leaders, and students in the classroom context, grounded in content; a reciprocal, inquiry-based, and collaborative exploration of the respective language, skills, and concepts of pedagogical disciplines and traditions.

Our DPSF (Figure 2) is informed by the principles and standards of democratic instructional leadership as well as our adapted ecological model of democratic pedagogy and supervision. The DPSF provides guidance, in the form of a teaching practice-specific tool, to help leaders increase the organizational capacity to enact democratic instructional supervision. Our focus on content-specific instructional questioning is a critical expression of this model, because it centers the instructional supervision process on concrete (and essential) teaching practice supporting distributed professional learning, integrates teachers' expertise in the work of teaching (Ball & Forzani, 2009; Stein & Nelson, 2003) into the process, and supports fidelity to the discipline.

Figure 2.
The Democratic Pedagogy and Supervision Framework (adapted from Cohen, Raudenbush, & Ball's (2003) instructional triangle conceptual model).



Dimension I. Defining Capacity to Implement Democratic Instructional Supervision

The first dimension of our framework focuses on developing the leadership capacity of all individuals in support of operational democratic school culture. We apply Stoll's (2009) definition of capacity building as "creating and maintaining the necessary conditions, culture, and structures; facilitating learning and skill-oriented experiences and opportunities; and ensuring relationships and synergy between all the component parts" (p. 117). Although in this paper we focus mainly on the school principal's role as a democratic instructional leader, we align with research and practice which has demonstrated the organizational capacity of teachers' peers (i.e. instructional coaches, teacher leaders, and mentors) and district-level leaders to develop and implement collaborative instructional cultures (Stein & Nelson, 2003; Woulfin & Rigby, 2017). Democratic leadership capacity is comprised of a system of interconnected values and norms shared among leaders and teachers, influencing the development of democratic instructional supervision cultures. A critical component of capacity building is teachers' expertise and the work of teaching, respecting teachers' contributions, voice, and collaboration across disciplinary areas within a school learning community.

Dimension II. Defining the Work of Teaching

The second dimension of our framework includes the work of teaching, which can include all content areas of disciplinary pedagogy and practice. Ball and Forzani (2009) define the work of teaching as "the core tasks that teachers must execute to help pupils learn" (p. 497). According to Ball and Forzani, the work of teaching includes engaging in activities and exchanges outside of the school and the classroom, with parents, the community; as well as inside the school and classroom, such as leading discussions, planning lessons, and collaborating with colleagues. Within their model of the profession, teachers should develop professional relationships based on pedagogies of practice that create and apply "language with which to talk about work" (p. 505). This language is derived from and shared among teachers' respective disciplinary pedagogies and content areas.

Dimension III. Defining Teacher Questioning

The third dimension of our framework focuses on teacher-student exchanges via content-based questioning. We want to underscore that we are using questioning as a case of a teaching practice since other practices could (and should) be used to build additional capacity for democratic instructional supervision. Improving teachers' questioning practice is critical since research has shown that skilled questioning improves students' access to learning (Caram & Davis, 2005; Lorent Deegan, 2010; Paul & Elder, 2009; Walsh & Sattes, 2010), and teachers struggle to ask a range of critical thinking questions (Boaler & Brodie, 2004; Hiebert & Wearne, 1993). We claim questioning is ubiquitous to the subject-specific work of teaching (yet challenging to master), critical to student learning, and a focus in the current teacher evaluation policy environment. We define a question as a verbal expression of inquiry and teacher questioning as a professional-pedagogical practice in which a teacher verbalizes at least one expression of inquiry directed at one or more students.

Dimension IV. Defining Leadership Content Knowledge

The fourth dimension of our framework draws from research that demonstrates the need for instructional leaders to further develop a specialized form of knowledge, called leadership content knowledge (LCK) (Nelson & Sassi, 2000; Stein & Nelson, 2003). LCK is defined as "knowledge about subject matter content [which] is related in complex ways to knowledge about how to lead" (Stein & Nelson, 2003, p. 424). Derived from teachers' pedagogical content knowledge (PCK), LCK conceptualizes leaders' content knowledge and their instructional leadership abilities to engage and enact in the work of teaching, including curriculum, standards, instruction, and student learning (Grossman & Stodolsky, 1995; Jones, 2007; Sassi & Nelson, 1999; Shulman, 1986). A leader's knowledge of the subject matter, or LCK, has been identified as a contributing factor of content area efficacy (Lochmiller, 2016; Spillane, 2005; Wieczorek, Clark, & Theoharis, 2018a) and the capability to establish distributed instructional supervision cultures of practice (Stein & Nelson, 2003). In our model LCK serves as an essential component for inquiry-based conversations between leaders and teachers regarding content-based pedagogy and democratic instructional supervision dialogue.

In the next section, we will apply this framework to illustrate a case of instructional supervision in secondary mathematics instruction, focusing on the processes of mathematical questioning and student engagement. Our case example demonstrates how leaders and teachers can build capacity to engage in dialogic, democratic instructional supervision practices, aimed to improve mathematics' teachers instructional questioning practices with the overarching aim of supporting teachers' professional learning and improving student learning outcomes. The illustrative case provides a model for democratic instructional supervision in other disciplines and content-based pedagogies.

Context

The purpose of this section is to illustrate our democratically-oriented approach to pedagogy and supervision as presented in the DPSF. Through this illustrative case, the DPSF is calibrated to adults' developmental learning processes, while democratizing the supervision through the decentralization of expertise in instructional supervision and explicit acknowledgment of the mathematical work of teaching and student learning (Ball, 2017).

In this illustrative case, our focus on teacher questioning in secondary mathematics is important for three reasons: questioning is a standards-based pedagogical practice which is important to student learning; the skilled use of questioning is a difficult practice for teachers to master, and focusing on mathematics questioning highlights teachers' work specific to mathematics instruction and provides principals with concrete mathematics' leadership content knowledge. Our focus on teacher questioning in mathematics also acknowledges that secondary teachers, as subject-specialists, may have forms of content knowledge that principals do not possess, in particular when the principals come from a different disciplinary background. We argue that principals' and teachers' capacity to engage in mathematics pedagogy and content can serve as a foundation for democratically-oriented instructional supervision dialogues, and the DPSF provides a model to build capacity for both teachers' and leaders' professional learning.

Environments – Why Does Seeing Secondary Mathematics Instruction as Part of the Ecological Environment of Instructional Supervision Matter?

The Common Core State Mathematics Standards call for high school teachers to teach and assess eight mathematical practices (National Governors Association, 2019; Table 1). Teachers must rely on a range of questioning strategies to support this instructional work, yet the research on questions is often either too theoretical or overly specific to guide this mid-level decision-making in teachers' practice (Enright et al., 2016). Boaler (2003) observed that the types of questions teachers pose to students more often than not position students to receive information, rather than develop their mathematical ideas. Therefore, there is a gap between what teachers are being asked to do in their instructional work and the questioning strategies they are employing to engage students in those eight mathematical practices.

This dissonance creates an urgent need for professional learning, which we argue needs to be attended to in instructional supervision. For principals and teachers to build instructional supervision capacity in mathematics, adults' developmental learning processes require that both teachers and principals communicate skillfully and precisely about specific and relevant

mathematical questions, which then correspond to appropriate instructional moves (Drago-Severson & Blum-DeStefano, 2019). However, specific research and practical guidance on teachers' mathematics questioning remains disconnected from the instructional supervision literature. We addressed this gap in three ways. First, we unpacked an ecological model for instructional supervision that names and creates space for the professional experience and expertise of teachers in instructional supervision (Table 1). Second, we constructed a framework that is grounded in the daily work of teaching (Figure 2), which builds capacity in the field of instructional supervision to have more democratic dialogues anchored in the subject-specific work of teaching, in this case, mathematics questioning. Third, we used the work of Enright et al. (2016) on mathematical questioning to illustrate how mathematical question types, and their functions in instruction, translate into types of leadership content knowledge (Table 2). We envision that these three contributions can be used together to orient instructional supervision conversations around mathematical as well as pedagogical practices. We unpack this work further through our illustrative case and a subsequent review of the literature.

Table 1
Common Core State Standards for Mathematics: Mathematical Practices (CCSSM, 2019)

Mathematical Practices	
1.	Make sense of problems and persevere in solving them.
2.	Reason abstractly and quantitatively.
3.	Construct viable arguments and critique the reasoning of others.
4.	Model with mathematics.
5.	Use appropriate tools strategically.
6.	Attend to precision.
7.	Look for and make use of structure.
8.	Look for and express regularity in repeated reasoning.

Table 2
Mathematical Questioning Articulated as Democratic Pedagogy and Supervision Practice
Question types and instructional functions adapted from Enright et al. (2016) with permission

Mathematical Question Type	**Teaching Function of Question**	**Dimension(s) of LCK for Democratic Supervision**
Direct Answer	Prompt students to give an answer to a problem	Discussion of student engagement Discussion of content Discussion of curriculum
Eliciting Mathematical Explanation	Prompt students to explain or justify their mathematical reasoning	Instructional feedback Discussion of student engagement Discussion of standards Discussion of assessment Content-relevant pedagogy
Eliciting Mathematical Process	Prompt students to describe a process for solving a mathematical problem	Instructional feedback Discussion of student engagement Discussion of standards Discussion of assessment Content-relevant pedagogy
Eliciting Mathematical Ideas/Thinking /Contributions	Prompt students to share their other ideas, not about explanation or process	Instructional feedback Discussion of student engagement Discussion of standards Content-relevant pedagogy
Eliciting a Stance on a Mathematical Claim	Prompt students to share their thoughts about a specific mathematical claim; this could include taking a position on the claim or sharing their thinking about one or more possible positions or on the claim itself	Instructional feedback Discussion of student engagement Discussion of standards Discussion of content Discussion of assessment Content-relevant pedagogy

Grounding Our Illustrative Case in Publicly Available Data. We decided to leverage the Trends in International Mathematics and Science Study (TIMMS, 1999) data to illustrate the application of the DPSF in secondary mathematics instruction. We decided on this approach because it allows us to situate the framework in the mathematical work of teaching (Ball, 2017) and uses the original data used to create the typology of mathematics questioning (Enright et al., 2016) on which this framework is based. The following transcript is a brief excerpt of a United States-based lesson on graphing linear equations from a publicly available video on the TIMMS

(1999) database. This excerpt launches small group work on a packet of problems by summarizing prior learning to remind students how to approach the graphing work. We will present the excerpt as it is in the original data in this subsection with a fictitious supervision dialogue created to illustrate our problem space, then we explain the application of the DPSF.

Our goal is to demonstrate how specific mathematical instructional dialogue can support principals' instructional leadership capacity and leadership content knowledge to effectively engage with teachers in democratic instructional supervision. Consider the following illustrative scenario - imagine a high school principal, a former English teacher, entering a mathematics teacher's classroom to observe a lesson as part of a clinical supervision model. Before the lesson, the teacher and principal collaboratively decided that they would focus on standards and practices related to teacher questioning during the upcoming classroom observation.

The principal is interested in learner-centered teaching and observing if the teacher asks students "more open" or "higher-order thinking" questions to create opportunities for students to talk with one another about their thinking. As a building leader, her goal is to build students' skills for more peer-to-peer interactions across the school, knowing how social engagement and belonging influences student learning. The teacher wants his students to practice explaining to one another how they go about graphing linear equations. He wants to learn how to better support students in comparing different approaches to graphing so they can think more strategically about which approach they use in their work. He believes that he can better support students in this mathematical work by broadening the types of questions he asks students during class discussions. Additionally, the teacher is in his third probationary year of teaching, and he knows his observation will be included as part of a formal professional evaluation which will be recorded in his personnel file as part of his annual review.

To begin, imagine that a principal is watching the teacher's lesson in which the following episode occurs:

Figure 3.
U.S. Mathematics Instruction - Graphing Linear Equations Excerpt: Using Questioning to Introduce Small Group Work (TIMMS, 1999).

00:01:20	**Teacher:** Okay, everybody within your group of four or three, you need to work together. I know normally we work in pairs. Okay? But I figured today you have another pair of students - You know, a couple of extra brains there to help you get through this little lesson. Okay? We've done this plenty of times before. Some of you honestly are still a little shaky. So, if you look at the packet which you are all sharing as a group - Page one has five equations I want you to graph. Now you can graph it any way that you know how to do it, as long as you do it correctly. Can someone raise their hand and tell me what's one obvious thing that I can do to graph? Nick?
00:02:04	**Nick:** The slope.
00:02:05	**Teacher:** Use the slope with the?

00:02:07	**Nick:** Y-intercept and X-intercept.
00:02:08	**Teacher:** Y-intercept. Right? That's probably the way you'll probably want to do it, right Nick?
00:02:11	**Nick:** Yeah.
00:02:12	**Teacher:** Is there another way, though? Robert?
00:02:15	**Robert:** Use the, um, tables.
00:02:16	**Teacher:** Right, to make a table for the equation, right? And then plot the points from the table. Everyone got that? So those are the two main ways, right, we can graph those equations? So right now I need you to get started. The key thing is when you're done with the first five, the first page, as noted on the paper, please make sure I check to make - Make sure you did it right before you move on. Okay? So go ahead and get started.

After the lesson, during the post-observation conference, the principal attempts to offer the teacher feedback on the questions asked during the lesson. The principal might say, “It would be good to expand the questions you are asking. For example, that one question you asked in minute two of the lesson — you know after the student in the front by the door said, ‘the slope’ and you responded with an incomplete question that was more of a prompt: ‘Use the slope with the…?’ The teacher and principal might then go back and forth trying to identify the moment and describe the question that was asked. They may refer to the district’s required instructional framework, such as the Danielson Framework, to help them bridge their discussion regarding content, pedagogy, and questioning. However, the framework they are using is instructionally broad and generic, so they struggle to connect specific content embedded language to describe the features of the question asked, or discuss other potential questioning strategies. The teacher’s understanding of what work he wanted the students to do in answering his questions could get lost in all the calibrating between the teacher and principal. Their differential positions of power also impact their ability to engage with each other due to overlapping and conflicting supervision and evaluation goals. This typical scenario exemplifies how principals and teachers may not have the mutual, collaborative capacity to understand and engage in democratic instructional supervision and professional learning practices that can help students’ mathematical learning outcomes. We argue that a shared language, of which the DPSF is an example, would do a great deal to acknowledge and tap into both the teacher’s expertise in teaching a specific content area and the principal’s expertise in leadership. We also believe a shared language rooted in the subject area allows for more targeted improvement of teaching practice and contributes to the development of a democratic supervision culture.

Discussion

In support of the DPSF, in this section we discuss the scholarly evidence and practice rationale for developing the DPSF, citing the area of mathematics questioning as one example to demonstrate the depth of content knowledge, pedagogy, and supervisory dialogue required on

behalf of teachers and leaders to develop and enact democratic supervisory cultures. We assert that these conceptual foundations can motivate conversations among and between scholars and practitioners to develop discipline-specific, pedagogical applications in other content areas and grade-level settings.

Why Build Capacity for Democratic Instructional Supervision?

Supervision scholars have identified purposeful, systemic efforts to establish collaborative leader-teacher dialogue as a means to develop democratic instructional leadership capacity among all members of the school community (Figure 1). For example, scholars have advocated for building "strong democracy," which includes the concepts of *inclusion*, *integration*, and *internalization*, to develop schools' democratic leadership capacity (Glickman, Gordon, & Ross-Gordon, 2018; Gordon, 2016; Gordon & Boone, 2014, p. 26). Drawing from these scholars' definitions, these concepts define a democratic culture that grants agency to all individuals, and representative groups of community members, to establish and engage in regular dialogue, collaboration, and consultation that becomes second nature to the organization. A leader's efforts to systematize democratic school leadership capacity requires "involving more groups and individuals in inquiry, dialogue, and decision-making…involvement of the community served by the school…[and including] different ideas and beliefs…[which are] interdependent" (Gordon & Boone, 2014, p. 26).

Previous literature on democratic instructional supervision has established foundational leadership practice standards that can foster growth and development in principals, field experience supervisors, and also preservice- and in-service teachers (Waite, 2005; Waite & Waite, 2012). The most prominent example, Waite (2005) stated eleven standards of democratic supervision. Waite (2005) argues that democratic instructional supervision should be "an educative process for both the teacher and the [principal] supervisor" (p. 42). Similarly, Ärlestig and Törnsen (2014) applied a model of "pedagogical leadership" which requires "democratic behavior wherein the willingness to involve and listen to others are necessary aspects" (p. 857). These examples identify widely accepted democratic supervision practices which are woven and integrated into various models of shared or distributed configurations of school leadership, including collaboration, community, communication, valuing individual input, and collective decision making (Wieczorek & Lear, 2018; Ylimaki et al., 2011). However, the field has not firmly established an empirically analyzed critical mass of evidence regarding practitioners' application of democratic instructional supervision standards in public schools.

One study documented evidence of emergent principles of democratic instructional supervision and discussed how dialogic and reflective inquiry were practiced consistently among all members of the school community (Gordon, 2008). Gordon found that each of the four communities took time to develop a shared vision of instructional supervision and professional growth, enact multiple processes to capture instructional evidence and professional learning, structure supervision as a collective endeavor, and foster reflective dialogue among all members of the school. Gordon concluded that shared instructional supervision dialogue contributed to improved learning outcomes, collegial professional cultures, and a shared purpose of professional growth among principals and teachers. Also, teacher leadership and broader concepts related to teachers' content expertise were cited as important factors of peer-to-peer

relationships, but the findings did not provide specific examples where principals and teachers engaged in content-specific conversations as part of their supervisory practices.

Why Focus on the Practices of Teacher Questioning and Student Dialogue?

We could have focused on a range of teacher and student interactions around content in the development of our ecological model for instructional supervision, yet we chose to focus on a teaching practice – teacher questioning. Our focus is deliberate, considering the importance of this practice to student learning, difficulty in mastering this practice for teachers, and centrality of this practice in teaching mathematics content. Questioning - has long been considered central to a teacher's instructional repertoire (Fitch, 1879; DeGarmo, 1903; Stevens, 1912; Shavelson, 1973; Dillon, 1988). Over a century ago, DeGarmo went so far as to claim, "To question well is to teach well" (DeGarmo, 1903, p. 179). Decades of research has shown that the questions teachers ask are profoundly important to student learning (Gall, 1970; Marbach-Ad & Sokolove, 2000; Rop, 2002; Stipek et al., 1998), in particular to the development of metacognition (e.g., McGregor, 2006), mental schemas used in problem-solving (e.g., Claxton, 1999; Greenleaf, 2006; McGuiness, 2005), and critical thinking (e.g., Chin, 2007; Levine, 2007). For nearly half a century, research has also linked increases in students' thinking and reasoning outcomes to teachers use of critical thinking questions (e.g. Andre, 1979; Blosser, 1973; Goodwin et al., 2020; Lustick, 2010; Koufetta-Menicou & Scaife, 2000; Redfield & Rousseau, 1981). While teacher questioning has been documented as the most common strategy for eliciting student thinking in instruction (Myhill et al., 2006), teachers struggle to skillfully ask questions accessing different types of student thinking (e.g., Greenleaf, 2006; Hardman, 2008; Hind, 2016; Lustick, 2010; Newton, 2013). Given the importance of teacher questioning to student learning as well as the documented difficulty in engaging in this teaching practice, we need a better understanding of how to support teachers in developing their capacity to skillfully leverage this practice in their teaching.

To begin, we need to build a shared understanding of what is teacher questioning. We define teacher questioning as a pedagogical practice. By pedagogy, we mean,

> …the observable act of teaching together with its attendant discourse of educational theories, values, evidence, and justifications. It is what one needs to know, and the skills one needs to command, in order to make and justify the many different kinds of decisions of which teaching is constituted. (Alexander, 2009, p. 5)

Teacher questioning is a practice in the sense that it is viewed as a set of coordinated activities performed by individuals or groups within a profession and that draw meaning from being situated in the profession (Lampert, 2010). For example, teachers ask students questions in ways that would seem *unnatural* for others in different contexts (Ball & Forzani, 2009), yet serve a variety of pedagogical purposes when utilized by professional educators. For example, asking a student the question - *how do you know that?* - is critical to eliciting student understanding, but would likely be perceived as an unusual question, at best, or a rude one, at worst, in an interaction outside of instruction.

Additionally, there is a growing consensus in the research that not all practices have equal weight in teaching and learning interactions, and some practices are central to the work of teaching, making them core practices (Grossman et al., 2009; Lampert & Graziani, 2009). While there are multiple frameworks for examining and categorizing core teaching practices, we adopted the taxonomy of high-leverage practices (HLPs) (Ball & Forzani, 2009; Ball et al., 2009). The following characteristics make a practice high-leverage: frequent enactment in teaching, universal application across instructional contexts, accessible to new teachers, offer opportunities to learn about students and teaching, respect the complex nature of instruction, and draw from a foundation in research (Grossman et al., 2009). Although teacher questioning is not defined as an HLP on its own, we argue that is an especially important practice since it is integral to multiple HLPs, including *eliciting and interpreting student thinking*, *checking student understanding*, *leading a discussion*, and *coordinating and adjusting instruction*.

Our focus on high-leverage is deliberate, as opposed to high-impact (e.g., Kuh, 2008) or other frameworks that tie practices more directly to learning outcomes. One reason for this choice in the language is that we subscribe to the belief that instruction does not cause learning but shapes the conditions under which learning occurs. We see teaching and learning as processes that may occur separately or interact in a shared space; we call this shared space instruction and use the instructional triangle to represent those interactions. Imagine, a hypothetical situation in which a teacher teaches skillfully in front of a classroom filled with avatars, programmed to respond in ways students commonly do in classrooms. Teaching is still occurring even though those avatars are certainly not learning. The reverse can also occur. A student may learn outside of an instructional environment where there is no teacher or teaching occurring. When teaching and learning occur in an instructional environment, the relationship is not direct and causal, but complex. An instructor and her teaching shape the environment but do not wholly construct it (Cohen et al., 2003), and therefore, cannot cause learning for students. Teaching can depending on its skillfulness impact the likelihood of learning taking place for students. Therefore, a focus on developing teachers' specific practices, such as questioning, through their professional learning is critical to improving the conditions for student learning to occur. This is yet another reason why we argue for instructional supervision to be grounded in the subject-specific work of teaching.

Finally, teacher questioning is an underdeveloped area of research (Boaler & Brodie, 2004; Enright & Ball, 2013; Enright et al., 2016; Fusco, 2012; Parks, 2010). A decade ago, Franke and colleagues (2009) argued that "little research-based evidence exists to help teachers make the transition from asking the initial question to pursuing student thinking" (p. 380), and Enright and colleagues (2016) confirmed more recently that conceptual frameworks and descriptive language for mathematics questioning are still insufficient to support teachers' professional development of questioning in their instruction. In mathematics instruction, in particular, scholars have worked to build more robust typologies to describe the instructional practice of questioning (e.g., Boaler & Brodie, 2004; Enright & Ball, 2013; Enright et al., 2016; Moyer & Milewicz, 2002; Shimizu, 2006; Webel & Conner, 2017).

Many of the current typologies used to describe questions in teaching can be problematic when used to support teachers' professional learning because they are not embedded in the subject-specific work of teaching (Enright et al., 2016). Take our illustrative example of an instructional

supervision dialogue in secondary mathematics as an example of the need to embed professional learning in the daily work of teaching, which is centered around content. The instructional leader and teacher struggle to communicate what they notice about the questions asked in the classroom because they do not have a common language to support their dialogue. We need more scholarship that identifies and advances the challenging work of teacher questioning within subject areas. Many of the question typologies available do not advance that daily work of teaching content. Questions are often described by the type of student response, such as open/closed answer questions (e.g., Lampert, 2001; Soucy McCrone, 2005); linguistic features of the questions, such as who, what, where, why, and how frames for questions (Costa, 2001); or even policy (or reform) orientation of questions, such as implicit/explicit questions (e.g., Parks, 2010). In other cases, scholars attend to the cognitive demands on the students, such as questions categorized by the level of cognitive processing for students (e.g., Bloom, 1984; Cecil & Pfeifer, 2011). These categorizations offer important information about the questions posed in instruction; however, they do not necessarily provide practical insight to support teachers and instructional leaders in looking for a common language grounded in content that can support conversations on improving practice.

A case for the *mathematical* work of teaching. For schools to realize the vision of democratic instructional supervision in mathematics, it is necessary to build leaders' and teachers' professional capacity to engage as co-learners in the mathematical work of teaching – referring to the pedagogical tasks teachers perform to facilitate students' mathematics learning (Ball, 2017). In other terms, the field of supervision can learn from the shift in mathematics education in which researchers shifted from focusing on "what mathematics do teachers need to know" to "how is mathematics used in teaching" (Ball et al., 2001 as cited in Ball, 2017, p. 13). Ball explains that much of the research before this shift claimed to focus on teaching mathematics, but in actuality, studied teacher cognition (e.g., capabilities of teachers). Ball argues that "research was not capturing the dynamic of what teachers do when they listen to students, make decisions about what to say next, move around the room, and decide on the next example" (p. 14). While the research on mathematics instruction is extensive, the research examining the mathematical work of teaching needs further development (Ball, 2017). Through the DPSF, we argue that scholars studying supervision can help advance this instructional improvement work. The refocusing on the use of mathematics in instruction is also crucial to advancing the field of supervision since research in mathematics education has identified what Ball terms as the mathematical work of teaching as a lever for the improvement of teaching in mathematics.

Researchers are also developing HLPs within academic domains, such as mathematics (e.g., Ball et al., 2009). Ball and colleagues argue that HLPs should be defined according to the complex nature of mathematics teaching (to ensure the practices were 'generalizable' and 'useful' across K-12 mathematics instructional contexts) and teacher education (to ensure that the practices chosen were 'teachable' to novices within the traditional constraints of the field). As a result, their criteria reflect their understandings of what makes a teaching practice high-leverage in mathematics instruction: "supports work central to mathematics; helps to improve the learning and achievement of all students: is done frequently when teaching mathematics; and applies across different approaches to teaching mathematics" (p. 461). In addition to the particular focus on mathematics, Ball and colleagues bring equity in as a criterion for a practice to be considered

high-leverage, "helps to improve the learning and achievement of *all* students" (p. 461, *italics added*).

A case for attending to teacher questioning in *mathematics*. Teacher questioning is also important to drawing out and building upon students' ideas in mathematics (Jacobs & Empson, 2016; Kazemi & Stipek, 2001; Sherin, 2002), which directly map onto CCSS and NCTM characterizations of skillful mathematics instruction. Research shows that teachers who ask a range of questions while teaching mathematics support students' questioning strategies, which is a powerful catalyst for thinking, problem-solving, and reasoning (Gillies, 2011; Wong, 2015). As noted, the CCSS underscores the importance of teacher questioning in mathematics, calling for teachers to ask questions that position students to build their capacity in mathematics by practicing the eight identified mathematical practices (National Governors Association, 2019). Additionally, open, probing questioning is a difficult practice for teachers to master in mathematics instruction (Brodie, 2007; Franke et al., 2009; Lampert, 2001; Soucy McCrone, 2005) and is particularly challenging to teach to pre-service teachers (e.g., Moyer & Milewicz, 2002; Spangler & Hallman-Thrasher, 2014; Milewski & Strickland, 2016; Teuscher et al., 2016; Webel & Conner, 2017). For example, research shows that teachers ask an "open-ended" question, such as "how did you solve that problem?" to prompt an initial explanation from a student about their problem-solving, but then struggle to build on that initial inquiry with other important questions (Franke et. al., 2009, p. 380). CCSS calls for teachers to support and assess students across a range of mathematical work, necessitating a range of different mathematical questions. Since even experienced teachers need support developing their mathematics questioning practice, this is an excellent case for exploration in the supervision literature.

Why Develop Leadership Content Knowledge?

The concept of LCK is critical to supervision, as Gordon (2016) explained, supervision practices "may have to be adjusted from classroom to classroom in order to address classroom context . . . . each classroom includes a unique combination of teacher, students, *subject matter*, lesson objectives, and so on" (emphasis added, p. 36). Jacobsen, Johansson, and Day (2011) stated that in democratic instructional leadership culture, a principal "must be a learner, i.e. a person who creates and merges school cultures and school structures by re-thinking and leading through the power of dialogue and discussion" (p. 118). The role of professional feedback during the supervision process is critical for teachers' reflection and instructional growth (Ärlestig, 2008; Hattie, 2009; Hattie & Timperley, 2007), and principals should have well-developed LCK to effectively communicate relevant, content-specific feedback (Nelson & Sassi, 2000; Stein & Nelson, 2003).

A case for developing LCK in *mathematics*. Principals' feedback and collaborative instructional dialogue is a critical part of supervisory models (Ärlestig, 2008; Feeney, 2007; Rigby et al., 2017); however, principals often struggle to provide relevant, content-specific feedback to teachers, particularly in mathematics (Katterfield, 2013; Lochmiller, 2016; Nelson, 2010; Nelson & Sassi, 2000; Rigby et al., 2017; Steele et al., 2015). In a case study of 18 administrators' participation in supervision practice seminars, Nelson and Sassi (2000) identified four main areas of mathematical LCK: "a) what counts as mathematical knowledge, b) how mathematics is learned, c) the nature of student engagement, and d) the nature of teaching" (p.

566). Subsequently, Stein and Nelson (2003) identified leaders' focus on how children learn mathematics, specifically the belief that "teachers should lecture less, ask fewer factual questions . . .[and] ask questions that require extended student reasoning and explanations" (p. 440). However, research has demonstrated leaders' inconsistent, or content-neutral approaches to supervision of mathematics instruction. Rigby et al. (2017) completed the most extensive study of teachers' perceptions of administrator feedback to date and found administrators only provided feedback on "easily observable aspects of instruction and classroom management" which were content-neutral and failed to support teachers' growth in specific math pedagogy strategies (p. 29). The authors recommended if principals are to continue as schools' main instructional leaders, that "significant resources are invested to support administrator learning [in content area instructional practices]" (p. 34), a recommendation echoed recently by other scholars regarding mathematics and science leadership preparation curricula (Cunningham & Lochmiller, 2019).

Few conceptual or empirical articles provide content or pedagogical language for principals to address specific instructional needs, such as the example of mathematical questioning (Carver et al., 2010; Nelson, 2010; Steele et al., 2015). One of the few examples of mathematics supervisory guidance intended for principals, Zepeda and Mayers (2013) provided content and pedagogical guidance for supervisors across the range of PK-12 mathematics classrooms. Drawing from documents published by the Maryland State Department of Education, Zepeda and Mayers outlined general descriptions of instructional strategies that aligned with national mathematics learning standards published by the National Council of Teachers in Mathematics (Leinwand, 2014). They also provided inquiry questions to signal principals to *look for* particular teacher and student behaviors in the areas of computation, problem-solving, and communication. For example, among these "look-fors" in algebra and geometry, they recommended, "Rather than simply telling and explaining, [do] teachers ask more questions to draw out high-level thinking, such as *why? explain? justify? elaborate?*" (emphasis in original, p. 136). The chapter does introduce mathematical pedagogical language related to standards of practice, however, this resource does not provide specific language regarding mathematical questioning in the classroom or strategies for principal and teacher dialogue.

The University Council for Educational Administration (UCEA) co-published an edited volume that contains three case studies of principal leadership of mathematics instruction, one each at the elementary, middle, and high-school level (Jimerson & Fuentes, 2019). The high school example, (Funderburk & Wilson, 2019) provides emerging leaders with a pedagogical framework titled "5 Practices for Orchestrating Productive Mathematics Discussions" to observe and understand students' mathematics' classroom discourse (Smith & Stein, 2011). The framework addresses NCTM 2014 standards to engage students in "productive struggle," by which teachers "facilitate meaningful mathematical discourse and pose purposeful questions," and to understand how teachers "*connect*, through questioning, the different approaches as well as previously addressed and future concepts" (Funderburk & Wilson, 2019, pp. 163-164). The case study and discussion activities highlight the need for administrators to learn and understand mathematical standards, pedagogical frameworks, and content-specific strategies to facilitate student dialogue in the geometry classroom, which are exemplified by teachers' questioning practices embedded within the mathematical work of teaching.

Research suggests that mathematics teachers' professional development and growth depend on content-specific pedagogical supports and feedback (Jacob et al., 2017; Kutaka et al., 2017; Covay Minor et al., 2016). While researchers increasingly focus on the mathematical work of teaching from pre-service and practicing teacher perspectives and the corresponding demands on mathematics content knowledge for teaching (e.g., Blazar et al., 2017; Hill et al., 2008; Ottmar et al., 2015; Speer et al., 2015; Swars et al., 2016), more work is needed to examine the specialized content knowledge school leaders need to support teachers' professional learning and leaders' supervision of mathematics instruction.

Conclusion

This article and proposed framework, integrating leadership and teacher content knowledge in the case of mathematical questioning, underscores the importance of instructional supervision as a critical opportunity for both teacher and school leader learning. The DPSF privileges the tenets of shared professional language, content knowledge, and expertise, as well as leadership knowledge and expertise to conduct democratically-oriented discussions of teaching practice. As a mechanism for school improvement, democratic instructional leadership describes school organizational cultures which value individuals, collective decision making, shared dialogue, and embrace full stakeholder participation in school improvement processes which impact teaching and learning (Gordon & Boone, 2014; Stoll, 1999; Woods & Gronn, 2009). Democratic instructional supervision is embedded within democratic instructional leadership principles and professional practices that effectively support teacher growth and professional learning in a democratic community (Glanz & Hazi, 2019; Gordon, 2016; Ylimaki & Jacobsen, 2013; Zepeda & Ponticell, 2019).

Within the existing ecology of education policy which leverages public school accountability and performativity to control professional behavior, developing, sustaining, and promoting democratic instructional supervision while working within existing teacher evaluation policies and bureaucratic hierarchies is challenging. We draw inspiration from Ylimaki and Jacobson (2013) who described principals' and teachers' democratic instructional leadership as a continuous *balancing act*; where they simultaneously respond to external accountability mandates while internally sustaining visions and processes that foster democratic communities and relationships. The DPSF represents an additional professional development resource tool for instructional leaders and teachers to mutually balance supervisory realities while valuing each other as pedagogical equals within a democratic school leadership community.

Continued Challenges and Possibilities for Democratic Instructional Supervision

What challenges might we continue to face in further democratizing school leadership and instructional supervision? We do not suggest that a democratic leadership culture can erase persistent policy contexts which bureaucratically reinforce principals' evaluative positions of power and conflate the purposes of instructional supervision and teacher evaluation (Murphy et al., 2013; Mette et al., 2017). Waite (2005) described the development and implementation of democratic leadership as a process that is subject to contextual influence and disruption, which he identifies as "policies, procedures, attitudes, dispositions…an amalgamation of forces at play, historical precedents, our mental models, our practices…and our interpretation and enactment of

them" (p. 39). These forces can be identified as teacher evaluation policies, entrenched organizational hierarchies, and instructional protocols which suppress school leaders' and teachers' abilities to develop the shared organizational capacity for democratic school leadership and supervision.

Contemporary organizational hierarchies and teacher evaluation policy expectations continue to constrain practitioners' capacity to develop and implement democratic instructional supervision. Studies of federal and state-level high-accountability teacher evaluation policies developed during No Child Left Behind (NCLB), Race to the Top (RTTT), and Every Student Succeeds Act (ESSA) have provided differentiated evidence regarding impacts on principals' instructional leadership (Campbell & Derrington, 2019; Elfers & Plecki, 2019; Lochmiller & Mancinelli, 2019; Neumerski et al., 2018; Rigby, 2015; Wieczorek, Clark, & Theoharis, 2018b). Overall, research findings have shown how instructional frameworks, which in some states and districts have been converted to evaluation rubric tools, often fail to address content-specific pedagogy, leaving principals and teachers without common knowledge and terminology to support meaningful instructional dialogue (Hill & Grossman, 2013; Lochmiller & Acker-Hocevar, 2016; Wieczorek, Clark, & Theoharis, 2018a), as seen in the fictitious dialogue in our illustrative example. These evaluation systems and tools together reinforce traditional, unilateral systems of power concentrated with the school administration which do not position, or respect, principals and teachers as engaged, professional equals.

In advancing a more democratically oriented, content-focused approach to supervision, we are also pushing against the walk-through model of supervision. For professional learning and improvement to take place for mathematics teachers, supervision visits need to have depth and translate the standards into the mathematical work of teaching. Generic frameworks do not prompt principals to engage with any subject-level depth. Thus, teachers' expertise may not be captured and valued in the supervision process. We believe the investment to move towards a more democratically oriented, content-sensitive approach to supervision will pay off in teacher learning, instructional improvement, teacher satisfaction, and improved learning outcomes for students. More research is needed to develop the typology of mathematical questioning as well as other critical areas of teaching practice, such as providing feedback. With more research, a set of frameworks could bridge principal and teacher expertise, supporting an overall shift towards more democratic school environments.

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