

**Building Teacher Learning Theory and Research in the Era of Student-Centered
Instructional Reforms**

by

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Dialogic classroom discussions in which students share ideas and engage in collaborative meaning-making around complex texts are critical for achieving ambitious reading comprehension goals in primary grades (Soter et al., 2008). Despite decades of research, however, such dialogic or ‘student-centered’ instructional approaches remain rare in K-12 classrooms (Murphy et al., 2018). One issue is that dialogic teaching practices embody an array of principles and aims that fundamentally subvert traditional notions of teaching and learning. These include, for example, epistemological assumptions about how knowledge is developed and conveyed (‘constructed’ vs. ‘transmitted’) and socially stratified norms about power and privilege in learning (Who has intellectual authority and legitimacy in academic spaces?) (Greeno, 2002). Together with the demands of learning new student-centered approaches, the deeply-entrenched nature of traditional pedagogical concepts and practices poses a daunting challenge for teacher learning and professional development.

The three studies of this dissertation address this issue by exploring ways to conceptualize and investigate the processes that facilitate robust teacher learning in the context of video-based coaching to implement dialogic text discussions in 4th and 5th grade classrooms. In Study 1, I draw on a ‘sensemaking’ theoretical lens to explore how teachers’ professional vision developed as they engaged in cycles of reflective dialogues with one expert coach. Study 2 extends this work to examine in-depth the relationship between teacher reflection and discussion practice, including

the role of key factors such as teacher ‘resistance’ and hierarchical ability-related assumptions for shaping differential learning and practice outcomes. Finally, Study 3 presents a conceptual argument based on adaptive expertise to identify key developmental processes for facilitating robust teacher learning in expert-guided reflection and mental simulation as a routine for instantiating this learning practice. The goal was to leverage interdisciplinary perspectives to contribute both a well-specified theory of teacher change as well as a model to inform the on-the-ground work of practitioners engaged in similar efforts. Taken together, these studies address the ‘black box’ of teacher learning theory and research from multiple perspectives and levels of analysis- an important ‘step’ for advancing more robust and equitable teaching and learning outcomes across contexts.

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1.0 Introduction

Reflecting the growing embrace of constructivist and socio-cultural learning theory perspectives in the learning and education sciences more broadly, education reform efforts have increasingly advocated for ‘dialogic’ or ‘student centered’ instruction in K-12 classrooms. Dialogic classroom discussions in which students share and explore their thinking to collectively make sense of complex ideas and concepts are a critical feature of reform approaches (Soter et al., 2008; Osborne et al., 2019; Kim & Wilkinson, 2019). To facilitate these discussions, teachers must support students to take an agentic role in their learning- eliciting students’ ideas and drawing out their emergent thinking- while also maintaining an active role in cultivating academically rigorous discourse by, for example, pressing students to explain their reasoning and critically examining claims put forth by themselves and their peers (Resnick, Michaels, & O’Connor, 2010; Clarke, Howley, Resnick, & Rosé, 2016). These efforts have been motivated by number of factors, including theory and research linking students’ engagement in inquiry-focused discourse to improved learning outcomes (e.g., Vygotsky, 1986; Wertsch, 1991; Nystrand, 2006), as well as a revived emphasis on the social justice and democratic functions of schooling as a means to empower student voice and civic participation (Hess & McAvoy, 2014).

Dialogic teaching is in stark contrast to traditional ‘transmission-style’ patterns of teacher-student interaction which characterize the large majority of classroom discussions (Chinn, Anderson, & Waggoner, 2001; Cazden, 2001). Learning to facilitate dialogic pedagogies thus places considerable demands on teachers’ knowledge and adaptive skill in the classroom. In addition to learning a complex array of new discourse moves, teachers must also learn how to create dialogic ‘space’ for students to lead discussion and hinge their instructional choices on an

ongoing assessment of students' developing thinking. Notably, these skills are not implicated in traditional 'transmission' instructional approaches wherein the teacher maintains tight control over the content and flow of classroom activity. Reflecting the behaviorist-oriented norms, assumptions, and aims of traditional schooling (Tyack & Tobin, 1994), standard classroom discussion practices maintain the traditional power dynamics that position teachers as the sole intellectual authority (or knowledge 'gatekeepers') and students as the passive 'receivers' of this knowledge (Tharp & Gallimore, 1988). Here, teachers' ability to 'read' and respond to student ideas and inputs is largely superfluous to the objective of successfully 'passing on' the discrete information students need to absorb and recapitulate on assessments.

This points to another critical challenge posed by dialogic reform pedagogies: They embody a way of thinking about the nature of knowledge, learning, and authority in the classroom that is fundamentally different from prevailing assumptions about the nature of teaching and learning and teachers' own experiences as learners (Kim & Wilkinson, 2019). These traditional assumptions about who determines the targeted 'knowledge' in classroom activity (i.e., the teacher) and how this knowledge is purveyed (i.e., through direct instruction or 'transmission') are deeply embedded in the 'grammar' of classroom teaching (Tyack & Tobin, 1994). Moreover, endorsement of a particular instructional approach (either tacitly 'inherited' or explicitly adopted) invokes a network of related pedagogical beliefs and practices that serve to mutually reinforce and perpetuate one another (Philip, 2011). The intractability of the ubiquitous I-R-E (Initiation, Response, Evaluation) pattern of classroom discourse (Mehan, 1979, Nystrand, 2006) highlights the pervasive and systemic nature of long-established pedagogical norms, assumptions, and behaviors (Spillane, Reiser, & Reimer, 2002).

Critically, not only can traditional pedagogical beliefs and practices undermine the rigor of learning for all students, they can also be especially problematic for achieving an equitable learning environment for particular students. A wealth of research shows that teachers' perceptions about the academic abilities of particular students – which may be motivated by socially and racially biased belief systems- substantively factor into their instructional decisions, often resulting in undermined learning opportunities for historically marginalized and racial minority students (Boaler & Greeno, 2000; Snell & Lefstein, 2018; Louie, 2016; Black, 2004). In principle, dialogic teaching disrupts deficit-based perspectives by positioning all participants as intellectually capable and elevating diverse perspectives as critical for enriching the learning of all students (Alexander, 2017). In dialogic ELA instruction, for example, it is assumed that a student's capacity to comprehend and analyze text is a function of the extent to which they are invited to legitimately participate in meaning-making processes, as opposed to, e.g., innate ability or positioning relative to mainstream norms and standards (Outlaw, 2021). However, when teachers view particular students as less capable of contributing substantive ideas or engaging in rigorous thinking, they often revert to low-inference questioning routines and other teacher-centered practices that undermine the agency and learning opportunities for students perceived as less academically capable (Ames, 1992; Snell & Lefstein, 2018; Black, 2004; Louie, 2016). These findings accord with other research suggesting implicit biases and racially stratified beliefs about student ability shape teachers' classroom expectations and practices in ways that disproportionately harm students from marginalized groups (Buehl & Fives, 2016; Rubie-Davies, Peterson, Sibley, & Rosenthal, 2015; Snell & Lefstein, 2018).

Transforming classroom discussions to be more dialogic in nature is thus exceedingly difficult for teachers, as it requires significant conceptual change- eliciting and restructuring

fundamentally problematic beliefs and practices- as well as the development of conceptual and procedural knowledge to understand and instantiate dialogic teaching goals in practice. Practice-based professional development that utilizes artifacts from teachers' own classrooms (notably classroom video) are growing in popularity as a means for supporting teachers' ongoing learning and development (Groshner, Seidel, Kiemer, & Pehmer, 2015; Borko, Jacobs, Seago, & Mangram, 2014). Rooted in situated learning and cognitive apprenticeship theory, expert-guided reflection around teaching practice (e.g., video-based coaching) in particular has become widespread, with near-universal consensus among scholars that ongoing reflective dialogue is essential for meaningfully transformation teacher thinking and practice.

Notably, research on the effectiveness of these programs has to date mostly centered on identifying the 'essential features' of professional development that shows positive effects on classroom discussions (Osborne et al., 2019; Sedova, 2017). While these studies have been successful at identifying key design elements of effective professional development as measured by aggregate changes in the quality of teachers' classroom practices, research also suggests that incorporating 'high leverage' design elements is necessary but not sufficient for ensuring positive change. One explanation for why reflection-based professional development programs sometimes show disappointing results, for example, is that while reflection in general (and video reflection in particular) is widely regarded as a critical component of teachers' ongoing professional learning, reflective activities can lack a clear connection to content- or discipline-specific learning goals or a coherent theory of teacher learning (Beauchamp, 2015; Osborne, 2019; Koellner & Jacobs, 2015). Moreover, significant variation can exist in the dissemination or facilitation of even well-specified reflective activities, leading to a variation in teacher learning outcomes that often goes unexplored (Tripp & Rich, 2012).

This problem points to an issue that has long plagued teacher learning research more broadly: Teacher learning processes and outcomes are generally under-theorized and under-researched (Lefstein, Louie, Segal, & Becher, 2020). This is partially a result of a strong focus in recent decades on identifying the “what” of effective professional development designs without comparatively little regard for the “why”, “how”, and “for whom” of effective teacher learning (Lefstein et al., 2020; Kim & Wilkinson, 2019). Relatively little is known, for example, about the nature of ‘productive’ reflection in a given context, how it informs changes in teachers’ understanding of their pedagogy, and how this learning can be rigorously assessed (i.e., beyond self-report assessments; Beauchamp, 2015; Stürmer, Seidel & Holzberger, 2016; Tripp & Rich, 2012).

Thus, there is a critical need for more research to go beyond the identification of key design elements or essential features to specify and examine hypothesized teacher learning mechanisms and outcomes in connection to specific theories of change- an essential exercise if we are to advance greater parity teacher and student learning outcomes (Correnti & Rowan, 2007; Shanahan, Tochelli-Ward, & Rinker, 2015; Correnti et al., 2020; Walsh et al., 2020). A critical part of this endeavor involves identifying theory-based frameworks that allow for teacher learning processes and outcomes to be conceptualized and studied in situ. This calls for researchers to devote more time and attention to process-oriented research to specify and analyze empirically testable mechanisms of learning within a conceptually coherent theory of teacher change. To enable a more rigorous and comprehensive study of teacher learning, this work should include deliberate efforts to integrate key insights from interdisciplinary domains (e.g., situated, cognitive, and sociological perspectives) and link teacher learning principles to critical context-specific features, including instructional principles and goals, professional development design features and activities, and the

micro-interactional processes and macro-structural narratives that comprise and situate teachers' sensemaking and learning experiences (Philip, 2011; Philip & Gupta, 2020).

1.1 Overview of Dissertation Studies

The three studies of this dissertation, described below, explored a variety of dimensions and questions aligned with this research and problem space. Notably, all three studies are situated in the learning context and principles of a particular teacher learning initiative, Online Content-Focused Coaching (Online CFC), that aimed to build 4th and 5th teachers' dialogic classroom text discussion facilitation skills through iterative cycles of lesson planning, reflection on classroom video, and experimentation with dialogic teaching practices over the course of a year-long intervention (see Matsumura et al., 2019). By focusing on one cohort of teachers who all engaged in the same program and with the same expert coach, each dissertation study therefore builds off of one another to enable a 'deep dive' and understanding of this particular teacher learning context, and an exploration of multiple perspectives and interpretive frameworks to contribute a more nuanced and comprehensive picture of key teacher learning processes and dynamics involved in more or less successful coaching experiences.

In Study 1 (published in the journal of *Teaching and Teacher Education* in spring 2020), I adapted a teacher 'sensemaking' lens based on an applied theory of teachers' professional vision (or 'noticing') to investigate change over time in the quality of teachers' reflection practice. Specifically, I analyzed teachers' verbal and written reflections to examine how teachers' noticing and reasoning about their videoed classroom interactions developed across multiple coaching cycles. The results from this study suggested that teachers became more focused on the connection

between their discussion moves and students' thinking in video, and their reasoning about these interactions became more interpretive and in-depth over time.

In Study 2, I built off these findings to explore how specific changes in teachers' professional vision ('reflection-on-action') related to conceptually-aligned, contemporaneous changes in their dialogic text discussion practice ('reflection-in-action'). Specifically, I conducted a comparative case study to examine in depth the relationship between teacher reflection and practice at multiple layers of complexity and specificity, drawing on a variety of data sources including teachers' reflective coaching dialogues, the coach's reflective journal notes, and targeted indicators of teachers' text discussion quality, including measures of change in the quality of students' discussion contributions.

Results suggested that as teachers became overall more adept at noticing and interpreting the link between their discussion choices and students' thinking in video reflection, their classroom text discussions became more dialogic (rigorous and interactive) over the same time period. There was, however, also considerable variation in teachers' rates of growth and outcomes with respect to the quality of their reflections and text discussion practice. In particular, further analyses suggested that teachers' ability and willingness to critically question their discussion choices, especially in light of evidence of disparate learning opportunities for some students in their classroom video interactions, was an especially influential factor for shaping teachers' differential learning trajectories in coaching. One notable insight from these analyses was the revelation that the more 'modest growth' teacher (pseudonym 'Debra') persistently drew on tacit beliefs and assumptions linked to the notion that her 'lower-level' readers have limited capacity to participate in rigorous thinking and meaning-making processes in discussion. From the coach's perspective, Debra's tendency to view her discussion interactions through this lens impeded growth in her

noticing and reasoning about the impact of her discussion moves on students' thinking, an interpretation that aligned with our professional vision analyses. This feature of Debra's reflection practice appeared to in turn contribute to the her relatively modest level of growth in responding productively to the thinking and ideas put forth by students in her classroom text discussions.

Finally, for Study 3, I integrated key concepts and insights from, on the one hand, teacher learning and professional vision research informed by a situated learning perspective, and on the other, research on individual knowledge development and conceptual change processes informed by social and cognitive psychological perspectives in learning. Specifically, I developed and explored another set of conceptual frameworks-based on *adaptive expertise* and *mental simulation*-to identify the 'key functions' that the literature suggests are collectively essential as a mechanism for developing teachers' adaptive expertise in expert-guided reflection (i.e., Framework for Adaptive Teaching Expertise) and develop a concrete teacher learning routine for instantiating these functions in professional development practice (i.e., Mental Simulations for Teacher Reflection). The goal of this paper was to weave together insights from situated and cognitive learning theory perspectives to contribute both a theory-based argument for how adaptive teaching expertise develops and can be facilitated, as well as a practical 'model' to guide the design of a high-quality teacher learning routine in this context

2.0 Study 1: Video-based Literacy Coaching to Develop Teachers' Professional Vision for Dialogic Classroom Text Discussions

Abstract

This study explores how 4th and 5th grade teachers' reflective practice developed as they participated in a remote video-based coaching intervention to implement dialogic classroom text discussions. Drawing on a professional vision framework, we analyzed teachers' verbal and written reflections to examine how teachers' noticing and reasoning about their videoed classroom interactions developed over time. Findings suggest teachers became more focused on the connection between their discussion moves and students' thinking in video, and their reasoning about these interactions became more interpretive and in-depth over time. Implications for research on how teachers learn dialogic pedagogies are discussed

2.1 Introduction

Education researchers across countries have long recognized the role of reflection for developing teaching expertise (Loughran, 2002; Beauchamp, 2015; Tannebaum, Hall, & Deaton, 2013; Rodgers, 2002a; 2002b). Widespread embrace of reflection as an essential component of teachers' professional learning grew from a rich body of scholarship marked by the groundbreaking insights of several notable education thinkers and scholar-practitioners (e.g., Dewey, 1933; SchÖn, 1983; Erickson, 2011; Rodgers, 2002a). Central to this literature is the idea that developing teachers' reflective practice, and in particular their ability to construct and leverage

new insights through critical inquiry about their pedagogy, is key to improving their classroom practice (Loughran, 2002; van Es & Sherin, 2008).

These reflective skills are especially critical when teachers are learning dialogic instructional approaches that require nuanced understanding of how to identify and grow students' thinking through dialogue. Recent decades have seen considerable momentum towards "student-centered" instructional paradigms across content areas (e.g., 'ambitious' or 'reform' pedagogy in math and inquiry or problem-based learning in science). Shared among these is an instructional vision that situates student thinking at the heart of classroom activity- a vision that can only be realized when teachers learn to facilitate meaningful discussions that elicit and grow student ideas (Sun & van Es, 2015). This calls for teachers to create dialogic 'space' for students to air their emergent thinking (e.g., posing an open-ended question or problem statement for students to explore) and nurture students' individual and collective thinking by, for example, marking and exploring differing interpretations, synthesizing across ideas to build coherence, and prompting students to explain their thinking and reasoning (Clarke, Howley, Resnick, & Rosé, 2016). When teachers adopt such inquiry-focused and responsive practices, rich learning opportunities emerge for both teachers and students (Franke, Carpenter, Levi, & Fennema, 2001).

Facilitating dialogic classroom discussions poses a particularly strong challenge for teachers, as it differs substantively from standard classroom discourse characterized by a pattern of teacher initiation, student response, and teacher evaluation of the response (Mehan, 1979; Applebee, Langer, Nystrand, & Gamoran, 2003) and deviates from deeply entrenched notions about the role of teachers and students in classrooms (Tharp & Gallimore, 1988). A broad research base suggests this 'transmission' model is remarkably consistent in classrooms across international contexts (Sedova, Salamounova, and Svaricek, 2014; Reznitskaya & Gregory, 2013; Nystrand,

1997; Burns & Myhill, 2004) despite strong evidence suggesting dialogic interactions are most effective for fostering robust learning (Cazden, 2001; Resnick, Michaels, & O'Connor, 2010; Lyle, 2008; Soter et al., 2008; Chinn, Anderson, & Waggoner, 2001; Nystrand, 2006).

This suggests that absent efforts to build teachers' reflective practice- and especially their causative thinking and reasoning about their discussion moves in relation to students' thinking - robust change in teachers' discussion routines is unlikely to occur. Classroom video is an especially potent tool in this regard, as it captures these teaching-learning relationships in their full complexity, making it ideal for identifying evidence of students' learning and inferring the influence of specific pedagogical moves on the rigor of students' thinking- critical skills for facilitating student-centered pedagogies (Borko, Jacobs, Eiteljorg, & Pittman, 2008; Sherin & Han, 2004; Brophy, 2004; van Es & Sherin, 2008; Tekkumru Kisa & Stein, 2014). Teachers' own classroom video can provide a particularly powerful learning context, as it conveys interactions that meaningfully connect to teachers' larger goals for themselves and their students (Borko et al., 2008) and can promote stronger links between teachers' professional learning (e.g., new instructional concepts and reflective insights) and the associated changes they can instantiate in practice (Sedova, 2017).

Though reflection is widely regarded as critical for teachers' professional learning, concerns persist from lack of clear definition of what productive reflection 'looks like' in a given context, how it informs changes in teachers' understanding of their pedagogy, and how this learning can be rigorously assessed (i.e., beyond self-report assessments; Beauchamp, 2015; Stürmer, Seidel & Schäfer 2016; Tripp & Rich, 2012). Calls to systematically investigate video reflection in particular as a means for building teaching expertise have proliferated- a vital exercise for the design and dissemination of richer teacher learning experiences (Gaudin & Chaliès, 2015;

Desimone, 2009; Berson, et al., 2015). Moreover, outstanding questions remain as to how video reflection influences teachers' learning across a broader range of professional development and instructional contexts (Koellner & Jacobs, 2015), particularly for in-service teachers' learning of literacy-focused pedagogies (Shanahan, Tochelli-Ward, & Rinker, 2015; Major & Watson, 2018)¹. Especially lacking is rigorous empirical work examining how in-service teachers' learning of dialogic, discussion-based forms of reading comprehension pedagogy develops through video-based professional development. This is particularly pressing given the implacability of transmission-style approaches and persistent evidence that students' critical thinking and reading comprehension skills are often significantly under-developed by the end of fourth grade (McFarland et al., 2017).

The present study addresses this issue by examining how teachers' reflective practice developed in the context of a video-based remote coaching intervention to implement dialogic text discussions in 4th and 5th grade classrooms. The central focus of this coaching model, which engages teachers in sustained, inquiry-focused dialogue around their videoed classroom text discussions, is to support teachers to interpret the effects of their discussion choices on students' thinking as evidenced in video, form hypotheses about the influence of alternative discussion moves, and make plans for subsequent lessons. Our primary goal was to investigate a method for characterizing and assessing meaningful transformation in teachers' understanding of their reading comprehension pedagogy as they engaged in these reflective coaching dialogues over time.

¹ Though important exceptions do exist (see, e.g., Arya, Christ, & Chiu, 2014; 2015; Osipova et al., 2011; Shanahan & Tochelli, 2014).

To accomplish this, we drew on professional vision (Sherin, 2007), a construct that describes teachers' ability to selectively attend to instructionally significant features and reason about these events using their professional and contextual knowledge. Professional vision can thus be understood as a dimension of teachers' reflective practice that captures their relative expertise for noticing and interpreting classroom interactions in relation to specific instructional goals (van Es & Sherin, 2008). Moreover, because professional vision emerges as an authentic representation of how teachers are viewing and making sense of their classroom practices in this context (i.e., as expressed through their coaching dialogues), it can be taken as an especially potent indicator of learning (compared to, e.g., self-report measures, Stürmer et al., 2016)- and in particular, the extent to which teachers cultivate an understanding of their reading comprehension pedagogy in connection dialogic discussion principles. We were especially interested in whether and how teachers' noticing and interpretation of the relationship between their discussion moves (i.e., their questions and rejoinders to students) and students' opportunities to engage in rigorous thinking about text developed over time. We propose that professional vision offers a compelling frame for analyzing an especially critical facet of teachers' learning to facilitate dialogic classroom text discussions- a key goal for professional development across international contexts.

2.2 Literature Review

2.2.1 The Role of Reflection in Teacher Learning

Since the seminal work of philosopher John Dewey, much education scholarship has focused on the role of reflection for developing skillful and responsive pedagogies (Dewey, 1933;

SchÖn, 1983). Reflection in education has been characterized as an exercise in purposeful inquiry—an examination of practice towards the goal of attaining new insights and drawing conclusions about alternative courses of action (Dewey, 1933; Tannebaum, Hall, & Deaton, 2013). As a professional learning activity, reflection should unfold as a process of ‘methodical thinking’ that problematizes practices that may have become routine or rote (Rodgers, 2002a; Loughran, 2002).

SchÖn (1983; 1987) built on Dewey’s work to further clarify the relationship between reflection and practice. This line of work defined reflective practice in terms of reflection-in-action, or framing and solving of a pedagogical problem in the midst of instruction (Zeichner & Liston, 1996), and reflection-on-action, or decomposing and analyzing elements of a teaching situation after it occurs. Because reflection-on-action enables deliberation absent pressure to respond, it provides a fruitful basis for teachers to discover rich and novel details about their practice - paving the way for more considered responses in their classrooms (Rodgers, 2002b).

Finally, reflection as a means for building teaching expertise is a socially mediated process (Rodgers, 2002a; Greeno, Collins, & Resnick, 1996). Research on practice-based professional development has similarly emphasized the role of interactive dialogue that is, importantly, anchored in real classroom artifacts (Ball & Cohen, 1999; Darling-Hammond, 2008; Putnam & Borko, 2000). Expert-informed guidance is also key for assisting less-experienced or knowledgeable colleagues in building knowledge, making informed inferences, and drawing new insights that can be tested (Vygotsky, 1986; Rodgers, 2002a; Marsh & Mitchell, 2014). From this perspective, reflective activities should be designed to support teachers’ critical analysis and discussion of their practice through the lens of well-defined pedagogical aims.

2.2.2 Professional Vision: A Framework for Characterizing Change in Teachers' Reflective Practice

A body of research exploring teachers' reflective practice in the context of student-centered pedagogies has focused on how teachers' noticing and interpretation of students' math and science thinking develops over time (e.g., Sherin & van Es, 2005; Sherin & Han, 2004; Tekkumru Kisa & Stein, 2014; van Es & Sherin, 2008; Sherin & van Es, 2009; Colestock & Sherin, 2009; Rosaen et al., 2008; for a review, Marsh & Mitchell, 2014; Gaudin & Chaliès, 2015). Often defined collectively as professional vision (Sherin, 2007; Sherin & van Es, 2009; Blomberg, Sturmer, & Seidel, 2011) these reflective skills are seen as a critical facet of teachers' ability to flexibly adapt their instruction to make optimal choices in response to students' learning progressions (Ross & Gibson, 2016).

Though variations exist, many researchers define professional vision (a term first coined by Goodwin, 1994) in terms of two interrelated processes: Selective attention and knowledge-based reasoning (Sherin, 2007). Selective attention refers to the situational features one notices. In a multi-faceted classroom environment, teachers must be selective in what they attend to—especially students' thinking and levels of understanding—to guide their pedagogical decisions. Because teachers often struggle to identify important cognitive indicators of learning (e.g., the logic of student ideas), developing teachers' selective focus on student thinking is a key goal (van Es & Sherin, 2010). Perhaps even more critically, teachers must learn to see their pedagogical moves in connection to students' thinking and instructional tasks, an acute challenge for many teachers who tend to view their instruction in isolation from students' classroom contributions (Tekkumru Kisa & Stein, 2014; Cohen & Ball, 1999).

The second process, knowledge-based reasoning, refers to how teachers make sense of their observations based on their professional and contextual knowledge. Researchers have emphasized teachers learning to adopt an interpretive ‘stance’ in their reflections, “where the goal is to make sense of student thinking using evidence from practice to reason through teaching and learning issues” (van Es, 2011, p. 135). This involves shifting away from a tendency to evaluate (i.e., making surface-level normative judgments)- often teacher’s default ‘lens’ for analyzing classroom interactions.

Importantly, when teachers learn to ‘see’ and interpret their practice through the prism of cause and effect, they also build more nuanced understandings of how to organize their instruction to achieve specific pedagogical goals. Reflecting on students’ discussion trajectory after reading aloud a text chapter and posing an open question, for example, a teacher may notice students’ contributions appeared disjointed or lacking in substantive lines of inquiry. Interrogating this further, she may also notice that this particular chapter featured a lot of ambiguity (e.g., metaphorical language or conflicting character narratives) and conclude that students had insufficient opportunity to grapple with, and form coherent insights about, these multiple meanings. This interpretation could then inform future planning decisions; i.e., she considers the complexity of information presented in each chapter (or adopts more nuance in determining ‘significant’ portions of text) and plans stopping points to elicit students’ emergent thinking about developing themes and explore potentially diverging ideas at these strategic moments.

As a construct that captures teachers’ active sense-making about their classroom interactions, professional vision can be characterized as a dimension of teachers’ reflective practice that emerges across contexts of focused deliberation (i.e., critical reflection around particular interactions or reflection-on-action) and facilitation (i.e., making in-the-moment instructional

decisions or reflection-in-action) (Sherin & van Es, 2009). It thus provides a fruitful lens for understanding how principles of dialogic teaching, richly elaborated on a theoretical level but notoriously elusive in practice (Reznitskaya & Gregory, 2013), can infiltrate teachers' thinking about their own pedagogy. As such, reflection artifacts should provide plenty of fodder for teachers to decompose and critically interrogate their existing classroom practices from a multiplicity of perspectives.

2.2.3 The Role of Video Reflection in Professional Development

Classroom video represents one such artifact that provides an ideal medium for developing teachers' reflective practice (Brophy, 2004; Borko et al., 2008; Sherin & Han, 2004). Much research on in-service teachers' professional vision or noticing, for example, has been in the context of video clubs, facilitator-led teams of teachers that analyze and discuss videos of one another's classrooms² (e.g., van Es & Sherin, 2008; Sherin & van Es, 2009; Sherin & Han, 2004). Several studies have found that through video club participation, teachers adopt a stronger focus on students' thinking and their reasoning becomes more interpretive and less evaluative (e.g., van Es & Sherin, 2008; Walkoe, 2015; Sherin & van Es, 2009; van Es & Sherin, 2006).

One important affordance of video is that it provides "entry into the classroom without the need to act" (Borko et al., 2008, pp. 419-420). That is, it conveys the complexity of real classrooms while allowing teachers to deliberate in ways that can lead to new insights (i.e., reflection-on-

² Though other designs do exist (see, for example, Tekkumru Kisa & Stein, 2014; Borko et al., 2011). Moreover, though our focus is in-service teacher learning, many studies also explore pre-service teachers' noticing or professional vision (see, for example, Barnhart & van Es, 2015; Rosaen et al., 2008; Star, Lynch, & Perova, 2011)

action; Brophy, 2004; Sherin, 2004). From a situated learning perspective, researchers have argued this is especially beneficial when teachers analyze their own classroom videos (e.g., Borko et al., 2008; Seidel, Stürmer, Blomberg, Kobarg, & Schwindt, 2011). In addition to providing a more authentic and meaningful context, this enables teachers to consider their initial ‘read’ of a situation in contrast to alternative theoretical perspectives (Harlin, 2014; Rosaen et al., 2008).

Video-based professional development can span a variety of forms, with some programs emphasizing collegial or group-level reflection (e.g., van Es & Sherin, 2008; Borko et al., 2011), while others opt for more targeted, individualized approaches (e.g., one-on-one coaching/reflective sessions; e.g., Sedova et al., 2016). The rise of online technologies has also introduced a range of designs that often include some ‘hybrid’ of in-person and web-based professional learning (Dede et al., 2009). Though not as common, some programs, including ours, feature entirely remote designs (e.g., MyTeachingPartner, Downer et al., 2011). While research suggests potential affordances and constraints to an entirely remote format (e.g., more cost effective and can enable more targeted focus on pedagogy, but may be less motivating for teachers who prefer in-person interaction), many researchers agree that the quality of the interactions and supporting participation structures is more materially important than the format itself (Clark, 1994; Powell et al., 2010).

As such, it is critical to note that teachers do not automatically accrue new insights from viewing video; rather, video must be integrated into purposeful activities that “induce particular modes of inquiry” and encourage “reflection, analysis, and consideration of alternative pedagogical strategies in the context of a shared experience” (Borko, et al., 2008, p. 419; Brophy, 2004). To cultivate teachers’ professional vision, for example, researchers have stressed the central role of a facilitator for planning and guiding teachers’ reflections, including selecting video clips that make students’ thinking visible, eliciting teachers’ thinking and encouraging inquiry, guiding

teachers to focus on evidence of student thinking, and modeling productive reasoning (van Es, Tunney, Goldsmith, & Seago, 2014). Selected video should also raise questions about complex or open-ended pedagogical issues (Borko, Koellner, Jacobs, & Seago, 2011), positioning teachers to inquire and learn from their teaching (Tochon, 1999). Lastly, because teachers' prevailing conceptions guide what they notice and how they interpret these events (Borko et al., 2011), it is critical to establish a shared 'vision' of effective pedagogy. This is especially the case with student-centered pedagogies, such as dialogic text discussions, that counter traditional beliefs and practices.

2.2.4 Video-based Professional Development to Improve Teachers' Classroom Discussion

Practices

Indeed, growing research across the U.S. and abroad suggests video-based professional development can positively change classroom discussion practices (see, for example, Chinn, Anderson & Waggoner, 2001; Berson et al., 2015; Fishman et al., 2017; Kiemer, Gröschner, Pehmer & Seidel, 2015; Murphy et al., 2018; Sedova, Sedlacek, & Svaricek, 2016; Resnitskaya & Wilkinson, 2015). A number of programs demonstrating positive classroom effects include some combination of formal learning (e.g., workshops) with ongoing opportunities for teachers to iteratively refine their practice through reflection and experimentation (e.g. personalized coaching). Several notable programs also specify a well-articulated model or theory of change guiding reflective activities (e.g., the Dialogic Video Cycle; Gröschner, Seidel, Kiemer, & Pehmer, 2015; Sedova et al., 2016) and cite video reflection as an especially 'critical element' (Desimone, 2009) for changing teachers' discussion practices (e.g., Sedova, 2017). Though still incipient, research specifically focused on efforts to improve classroom discourse has emphasized several

key design elements, including sustained reflection interwoven with experimentation; a dialogic, co-inquiry approach to discussing video; and establishing a repertoire of discourse moves that teachers can leverage in their classrooms (Wilkinson et al, 2017).

In sum, though a small but growing base suggests the promise of video-based professional development for developing teachers' dialogic discussion proficiency, relatively little research has directly investigated how teachers' learning develops in these contexts (with some exceptions; e.g., Sedova, 2017). In particular, little research has explored how teachers' thinking about their discussion practices changes through video reflection or identified specific dimensions of teachers' reflective practice to target for cultivation or change. Indeed, teachers' professional learning more generally has been under-theorized-what has often been termed the "black box" of professional development (see e.g., Kennedy, 2016; Thompson, Windschitl, & Braaten, 2013; Munter & Correnti, 2017). Research that has developed towards understanding how teachers learn student-centered pedagogies has largely concentrated in math and science. Research is needed to provide insight into how teachers' reflective practice transforms in other domains (e.g., dialogic reading comprehension) and professional development contexts (e.g., video-based coaching). Research is also needed to deepen and expand professional vision scholarship, including the need "to learn more about the relativity of teacher noticing, its varieties in differing circumstances of pedagogical use" (Erickson, 2011, p. 33). Together with increasing calls for teachers to facilitate more responsive and dialogue-rich reading instruction, this suggests, from a teacher learning perspective, a critical deficit in the literature (Gibson & Ross, 2016). Bridging conceptual and empirical insights from professional vision research, we frame this as a need to better understand teachers' learning to notice how dialogic interactions unfold (and fail to unfold) in their classroom

text discussions and the role of their facilitation choices in shaping students' opportunities to think and reason constructively about text.

2.2.5 Present Study

This study is situated within a larger three-year project to develop a web-based version of an established literacy-coaching program (Online Content-Focused-Coaching, CFC) developed at the Institute for Learning (IFL) at the University of Pittsburgh. The Online CFC instructional model is based on socio-cognitive learning theories that foreground the role of inquiry-focused dialogue for developing students' reading comprehension and critical-analytic thinking skills (Resnick et al., 2010). Teachers nurture this development by supporting students to engage in the bulk of thinking and meaning-making in classroom discussions. Teachers learn to implement and refine this approach through ongoing cycles of coach-guided reflective dialogues around their videoed discussions. Guided by a professional vision framework, our analyses drew from two sources of these dialogues (written and verbal) to address the following questions:

RQ1: In what ways does teachers' selective attention shift as they reflect on their classroom text discussions over the course of the coaching?

RQ2: In what ways does teachers' knowledge-based reasoning shift as they reflect on their classroom text discussions over the course of the coaching?

In addition, we present vignettes from initial (cycle 1) and late-stage (cycle 3) coaching sessions to illustrate how teachers' professional vision developed in this context and begin to explore the role of coaching discourse for supporting these changes.

2.3 Research Design

Developing Online CFC involved multiple design cycles with several teacher cohorts. Data for the present study draws from Study Year 2, our final design cycle. Our sample includes only teachers who successfully completed at least three coaching cycles (n= 6 teachers; 5 females). Teachers were recruited from a Northeastern U.S. school district through study advertisements for all 4th and 5th grade teachers on the district job website. Teachers in our sample worked in schools serving mostly low-income and ethnic-minority students, had an average of 17.5 years of teaching experience overall, and 8.4 years teaching at either the 4th or 5th grade level. All teachers reported Online CFC was the only literacy-coaching they received that school year.

2.3.1 Online Content-Focused-Coaching (CFC)

Online CFC features two phases: A six-week online workshop to build teachers' knowledge of the instructional model (described below) followed by a series of personalized remote coaching "cycles." The coach is a literacy expert trained at IFL, a practitioner-focused research institute at the University of Pittsburgh. Teachers are provided with a common set of texts that feature high levels of "grit" (i.e., rich material that includes, e.g., complex or ambiguous storylines and characters) to implement during coaching: *A Game of Catch* by Richard Wilbur (a short story), and *A Long Walk to Water* by Linda Sue Park (realistic fiction novel).

2.3.1.1 Phase 1: Online workshop.

Workshop content focuses on Questioning the Author (Beck & McKeown, 2006) and Accountable Talk (Michaels, O'Connor, & Resnick, 2008). Questioning the Author (QtA) draws

on cognitive science research that characterizes text comprehension as an active and inferential process of building a mental representation of situations described by a text (e.g., Kintsch & van Dijk, 1978). Accountable Talk draws on sociocultural theory (Vygotsky, 1986) and research in the learning sciences (Bransford, Brown, and Cocking, 1999). This approach emphasizes building students' critical-analytic thinking by marking and exploring differing interpretations, eliciting students' evidence-based reasoning and explanation, and supporting students to build on each others' ideas and connect to larger text themes. Drawing also on situated learning theory (Collins, Brown, & Holum, 1991), workshop activities include opportunities to study the theory underlying dialogic text discussion, analyze video exemplars, co-plan lessons, and collaboratively reflect through discussion boards.

Upon workshop completion, teachers receive the Framework for Effective Text Discussions, a document summarizing the seven key dimensions and exemplifying evidence of QtA and Accountable Talk (see Tables 1 & 2). The Framework thus serves as a boundary object (Star & Griesemer, 1989) that establishes a shared conceptual foundation to support coaching interactions. In particular, the Framework specifies how principles of dialogic discussions are instantiated in practice ('teacher moves') and evidenced in students' contributions ('student moves'), creating a coherent set of learning activities across intervention phases. Moreover, it anchors coaching dialogue in a shared language to interpret the evidence (or lack thereof) present in videoed interactions, enabling productive joint-meaning making. Finally, to facilitate their coaching transition, teachers receive a model lesson plan, pre-populated with ideas for stopping points and open-ended questions, to implement during their first coaching cycle.

Table 1 Framework for Effective Text Discussions (QtA dimensionsions)

Questioning the Author Dimensions	Teacher moves	Student Moves
Select a complex text with grist	<ul style="list-style-type: none"> • Select a text with grist/complexity that supports extended responses and meaning-making 	<ul style="list-style-type: none"> • Demonstrate motivation to persist and grapple with challenging content
Segment the text	<ul style="list-style-type: none"> • Identify stopping points that provide opportunities to unpack text difficulties • Plan initial questions and potential follow-up questions 	<ul style="list-style-type: none"> • Engage in making sense along the way
Pose questions to construct the gist of larger text themes and ideas	<ul style="list-style-type: none"> • Ask open-ended questions that support students to respond in more elaborate ways to explain larger text themes and ideas • Ask questions that surface students' potential misunderstandings 	<ul style="list-style-type: none"> • Demonstrate understanding of key ideas in the text • Respond using own words rather • Respond in longer ways that connect ideas within the text
Pose cognitively demanding questions	<ul style="list-style-type: none"> • Ask questions that link text ideas to broader issues in the discipline or world • Ask questions that require text interpretation and analysis 	<ul style="list-style-type: none"> • Form generalizations, claims, and/or arguments about the text

Table 2 Framework for Effective Text Discussions (Accountable Talk dimensions)

Accountable Talk dimensions	Example Teacher Moves	Example Student moves
Develop accountability to accurate knowledge	<ul style="list-style-type: none"> • Mark critical ideas expressed by students • Press for accuracy in students’ responses • Build on students’ prior knowledge 	<ul style="list-style-type: none"> • Demonstrate accurate knowledge of the ideas in the text • Identify knowledge not yet available but needed to address an issue
Develop accountability to rigorous thinking	<ul style="list-style-type: none"> • Challenge students’ explanations • Press students to explain their reasoning • Invite students to expand on their thinking • Model reasoning (i.e., think aloud) • Recapitulate ideas expressed in the discussion 	<ul style="list-style-type: none"> • Explain their reasoning about text-based evidence • Test understanding of concepts • Formulate hypotheses based on text evidence • Challenge the quality of each other’s evidence and reasoning
Develop accountability to community.	<ul style="list-style-type: none"> • Invite participation to ensure that all students participate in the discussion • Link students’ ideas in the discussion (i.e., show how critical ideas expressed by students relate to one another) • Work to keep everyone together • Verify and clarify students’ contributions to ensure that the student is understood 	<ul style="list-style-type: none"> • Engage in active participation in classroom talk • Listen attentively to one another • Elaborate and build on each other’s ideas • Work to clarify or expand an idea

2.3.1.2 Phase 2: Personalized coaching.

The overarching goal of the coaching is for teachers to build a nuanced understanding of how their discussion moves shape students’ thinking opportunities. Rooted in situated learning theory, the coach’s primary role in this process is to facilitate teachers’ thinking and meaning-making around their videoed interactions. The coaching design also closely aligns with key features of video-based professional development, described in the previous section, for cultivating teachers’ professional vision and facilitating their learning of dialogic discussion practices. Throughout each coaching cycle, teachers are therefore supported to construct their own

interpretations of their classroom interactions, with the coach providing appropriate scaffolds as needed. Each coaching cycle consists of three phases:

2.3.1.3 The pre-lesson phone conference.

Each cycle begins with a pre-lesson phone conference to discuss the teacher's lesson plan (previously emailed to the coach) and establish which Framework dimensions will serve as the focus for the cycle. Coach and teacher then discuss how the teacher will pursue these goals, including adding and revising questions in the existing lesson plan. Teachers then record and send their videoed lesson to the coach. The latter two phases of the cycle, the online written reflection and post-lesson phone conference, comprise our data sources for this study.

2.3.1.4 Online written reflections.

Upon receipt of the videoed lesson, the coach selects three 2-3 minute segments that highlight interactions pertinent to the teacher's discussion goals. At least one clip is selected to show a successful interaction relative to an established goal; remaining clips are selected for reflection on the potential impact of alternative moves towards an established goal. In both cases, segments are selected to highlight students' thinking levels and the connection (or disconnect) between teaching moves and students' opportunities to think and reason about text.

The coach then uploads selected clips onto the Online Coaching Interface (OCI) developed at the University of Virginia's Center for Advanced Study of Teaching and Learning (CASTL) and integrates them into a template that features a reflective prompt and space for the teacher to write in response to a reflective question for each clip (three per cycle). The reflective prompts are designed to assist teachers in using specific video evidence to make connections between their teaching moves and student thinking (see Excerpt 1).

Excerpt 1 Example reflective prompt around posing cognitively demanding questions

Reflective Prompt:

In this first video segment, you are into the discussion of the Cognitively Demanding Question you posed and wrote for the students to consider: *Loss is a theme in this story. What do you believe are the three most significant losses that Salva has experienced so far? Use evidence from the text to support your thinking.* At this juncture, you invite a reluctant student to share her view of the three most significant losses, and she does so with some encouragement. Her contribution adds another idea not previously discussed, and other students respond with both agreement and disagreement, using text support for each. Using the Framework as a guide, what do you notice about your students' thinking in this discussion? How does the question impact their thinking?

2.3.1.5 Post-lesson phone conference.

Each cycle ends with a post-lesson phone conference (approximately one hour) in which coach and teacher synchronously watch the video clips (each at their own computer) using selected Framework dimensions as a lens for analysis. The coach begins the conversation around each clip by recapping the teacher's written reflections and posing an open-ended question (e.g., What do you notice in this segment in relation to accountability to rigorous thinking?) prior to watching the clip. After the clip ends, the coach prompts the teacher to articulate her thoughts. Throughout the ensuing discussion, the coach uses discourse moves to elicit teacher reasoning with evidence (e.g., What about students' contributions made you think they understood the big idea?) and orient the teacher to consider discussion moves in relation to students' thinking (e.g., What happened after you pressed the student to explain their answer?). The coach also elicits the teacher's reflections about how alternative moves may have achieved specific discussion goals, encouraging him/her to draw on new insights to reason through future facilitation decisions. Finally, although the

overarching focus is to support teachers in constructing their own interpretations, the coach also offers her interpretations to model productive pedagogical reasoning (e.g., drawing from specific video evidence to infer meaning) and challenge teachers to consider alternative perspectives.

Our ‘theory of change’ for how these coaching interactions develop teachers’ learning begins with the premise that, as is the case with student-centered pedagogies generally, facilitating dialogic text discussions requires the ability to effectively make sense of the plurality of information materializing during instruction (e.g., student conjectures about the significance of particular text events) and draw on an integrated knowledge base (connecting procedural, conceptual, and experiential knowledge) to make informed decisions in response to ongoing assessments of students’ learning (Erickson, 2011). In the context of dialogic text discussion, this involves teachers understanding both how to plan discussions in ways that allow for student ideas and voices to proliferate (e.g., strategically-planned open questions), as well as how to identify and interpret the substance of students’ contributions to leverage as they continually adapt their facilitation in response to students’ thinking.

Based on a cognitive apprenticeship model (Collins, Brown, & Holum, 1991), the coach develops this learning by engaging teachers in sustained reflection on various problem situations and supporting them to analyze their classroom interactions in relation to well-specified dialogic discussion principles (instantiated in the Framework) with scaffolding and guidance from an ‘expert’ perspective. Through participation in these reflective dialogues over time, teachers build more nuanced and conceptually integrated knowledge of the interplay between their discussion choices and the trajectory of students’ individual and collective thinking about text. As a lens through which teachers process and make sense of their classroom interactions- including what they notice and how they ascribe meaning to these events- professional vision thus provides a

strong indicator of the sophistication of teachers' practical understanding of the instructional model and a framework for assessing meaningful developments in their learning over time.

2.3.1.6 Data Analysis

To examine developments in teachers' professional vision through coaching, which lasted from January to May of 2016, we analyzed the first and third cycles of teachers' written reflections recorded in the online platform (3 written reflections per teacher per cycle; 36 total) and transcripts of post-lesson coaching conferences (1 transcript per teacher per cycle; 12 total). We focused on these two coaching cycles to allow sufficient practice for teachers to reflect and implement the model. More practically, since most teachers engaged in only three coaching cycles, this also enabled consistent comparison across teachers.

Our analyses were primarily qualitative in nature, grounded in descriptive and thematic coding processes to determine meaningful code categories, distinctions, and hierarchies (Miles & Huberman, 1994) while also drawing from methods for quantifying qualitative data (Chi, 1997) to identify larger patterns of change over time. Efforts to address our research questions consisted of several rounds of iterative coding using Nvivo 10 Software for analysis (QSR International, 2012). All transcripts and written reflections were assigned random IDs to de-identify teacher and cycle numbers. The first author then segmented all transcripts of the post-lesson conferences to identify all instances of teacher reflection (i.e., all teacher talk that included reflective comments about their classroom practice). Because teachers' written reflections were naturally bounded by the space allotted to respond to the coach's online prompts, these data did not require this reduction step.

Mirroring coding procedures established in other research (e.g., van Es & Sherin, 2008; Tekkumru Kisa & Stein, 2014) teachers' verbal and written reflective comments were then divided

into “idea units,” defined as a “distinct shift in focus or change in topic” (Jacobs & Morita, 2002) or “meaningful chunks” (Grant & Kline, 2004). The process for determining what constitutes a meaningful “chunk” or idea unit unfolded over multiple discussions between the first and second authors where a range of teachers’ transcripts were jointly analyzed line-by-line (Straus & Corbin, 1998). Agreement was reached that idea units were best determined holistically- accounting for the context in which comments were made (including, e.g., naturally occurring differences in teachers’ styles of speech; Goffman, 1981; Chi, 1997). Hence, the boundaries for each idea unit were determined through careful consideration of where meaningful shifts in the *substantive* focus of teachers’ reflective comments occurred. This accords with prior research highlighting the value of conceptualizing meaningful units of analysis in context (rather than, e.g., adhering to pre-determined standards or rules for ‘correct’ grain-size, Chi, 1997; van Es & Sherin, 2010). The first and second authors then independently coded idea units for two full transcripts and resolved any lingering ambiguities or disagreements. After the procedure had been stabilized, the first author proceeded to segment all remaining teacher reflections (written and verbal) into idea units.³

Each idea unit was then coded using a professional vision framework built off of previous work (most notably, Sherin & van Es, 2009; Tekkumru Kisa & Stein, 2014; van Es, 2011) and adapted to reflect the context and goals of our study, including new codes/sub-codes and definitions that emerged from our data (Miles & Huberman, 1994). To analyze shifts in teachers’ selective attention (RQ1), we coded each idea unit expressed in teachers’ written and verbal

³ It should also be noted that although our analysis was isolated to teachers’ expressed reflective comments, the focus of teachers’ reflections in both the written and verbal reflections was ultimately a product of the interaction between the coach and teacher. Hence, although not explicitly analyzed, it is assumed that the coach had a significant influence in guiding the focus of teachers’ reflections.

reflections according to its “topic.” Idea units coded as “pedagogy” were further analyzed to capture whether and to what extent they referenced students (see Table 3 for definitions and examples of all main and sub-codes). Capturing these specifics allowed us to examine developments in teachers’ noticing of their pedagogy in relation to students’ thinking over time - a key coaching goal.

Table 3 Description of Codes Related to Teachers' Selective Attention (i.e., Topic)

Topic Codes	Definition	Example
Student thinking	How students are making sense of text content; what they appear to think or understand	“But she’s also relating to Salva, the fact that he’s been left behind time and again...she goes on to talk about the cold fist grabbing his heart. I can think of at least five of my students whose mothers have left them...so I think they really connect to that theme of the feeling of loss in Salva’s story.
Pedagogy		
Pedagogy not explicitly tied to students	Teacher’s actions (or possible actions) with no explicit relation to student thinking or discussion	“The third video...I think I rushed through it because I realized when I was kind of like 30 or 40 minutes or something...I needed to kind of speed it up so I just reworded the question in a way that I thought it was an open-ended question but I don't know what you think about that...”
Pedagogy explicitly tied to students, at a general, non-content-specific level	Teacher’s actions (or possible actions) in relation to students’ discussion participation at a general level	“It kind of started with an open-ended question. So with that first teacher move, they have to respond in longer, more elaborate ways. So we hadn't read the text yet, but it gave them a hook and an interest into why they're gonna read that portion.”
Pedagogy explicitly tied to students at a specific, content-informed level	Teacher’s actions (or possible actions) that influenced, could have influenced, or were influenced by students’ thinking and/or something specific that a student(s) said about text	“So that goes along with what [the previous student] was saying, that he might feel safe to see someone from his own tribe. I didn’t want to steer too far from the initial question...but now as I’m reflecting, I’m thinking maybe we should have gone back in the text and recapped and reread about the government and the rebels, and then maybe ask [the students], ‘who are these rebels?’ That may be something I would have to further explain, because they're looking at it as four separate groups...the government, the rebels, and the two tribes. I think they're confused by who the rebels are and exactly who the author is talking about.”

General Student Discussion/Participation	How students are generally discussing text content or how they are engaging in the discussion (e.g., levels of enthusiasm, whether students are paying attention, etc.).	“They construct that meaning, yes absolutely. I think with this group of kids that I have this year, they do a great job of that, of sharing their ideas... So, they’re speaking their thoughts and then one person says, “Oh, I thought,” and then they kind of piggyback off one another.”
Classroom Management	Issues related to student behavior, outside disruptions, or other material or logistical factors/constraints affecting facilitation of the discussion	“The lesson as a whole definitely went on too long, much longer than I thought...and one of my students who doesn’t [normally] misbehave was misbehaving. I’m not sure either about how they’re sitting. I wonder if they should’ve been at their seats.”

Table 4 Description of Codes Related to Teachers' Knowledge-based Reasoning (i.e., Stance)

Stance codes	Definition	Example
Evaluative	Evaluating the quality of a classroom scenario; making explicit judgments about what was good or bad or should have been done differently <i>without</i> attempting to understand why events occurred as they did	“They came alive, because there’s some days that the discussion is better than others...It really was one of their better discussions.”
Descriptive Interpretive-Surface	Giving a literal description about what was happening in a classroom scenario Looking at a teaching situation for the purpose of understanding what happened, what students think about the subject matter, or how a teacher move influenced student thinking <i>without</i> reference to specific video evidence and elaborated reasons in support of interpretations (i.e., gives a “what” but no “why”)	“I stopped and addressed her misconception and like I said I pressed for accuracy and we found it with the help of other children plus herself and we were able to correct her mistake and then move on” “I think [the students] were really struggling to grasp the big ideas in this chapter. Like, one of my main points to get across was simply the idea that water is important for survival and I don’t think that really came across in their discussion.”
Interpretive- In depth	Looking at a teaching situation for the purpose of understanding what happened, what students think about the subject matter, or how a teacher move influenced student thinking <i>with</i> reference to specific video evidence and elaborated reasons in support of interpretations (i.e., gives a “why” in addition to the “what”)	“When I pressed for accuracy, I noticed students found specific details in the text to support their responses. Like when I asked how they could tell the boys would be friends, students pointed out several examples within the text having to do with commonalities, actions, and feelings. Also when I pressed for reasoning asking, ‘What does that mean all the way to his heart,’ they were able to defend and explain their claims as one student explained it meant that they had the same feelings.”

To examine teachers’ knowledge-based reasoning (RQ 2), we coded each idea unit in teachers’ written and verbal reflections to capture the nature of teachers’ reasoning about their classroom interactions. Accordingly, each idea unit was assigned a main code representing one of

three types of analytic stance: 1.) Evaluative; 2.) Descriptive; or 3.) Interpretive. Idea units identified as “interpretive” were further analyzed to describe the depth and specificity of these interpretations, allowing us to capture finer-grain changes in the quality of teachers’ reasoning about their classroom interactions (see Table 4 for definitions and examples of all main and sub-codes).

Our process for coding teachers’ professional vision proceeded through several stages of developing, applying, and refining our analytic framework. To begin, the first author analyzed a subset of post-lesson transcripts and written reflections along each professional vision dimension. During this process, all authors met on multiple occasions to discuss code determinations and definitions. Once our coding procedures were stabilized, the first and second authors independently coded a larger subset of transcripts to discuss and resolve issues with the coding framework, sharpen code types and definitions, and clarify distinctions between all codes and sub-codes (Miles & Huberman, 1994). Through multiple iterations of applying and refining our codes, we developed a codebook that included detailed code definitions, examples, rules and decision-making guidelines. Once our final codebook was established, the first author coded the entire corpus of transcripts. After completing this first full pass, the first and second authors again discussed a subset of transcripts to further resolve any uncertainties. The first author then completed a second full pass, assigning final codes for all idea units in teachers’ verbal and written reflections for cycles one and three. The second author then blind-coded 25% of randomly selected transcripts from teachers’ verbal and written reflections; half were drawn from cycle one and half from cycle three. Initial exact agreement was 85% percent for all codes and sub-codes across both dimensions. All disagreements were discussed until 100% consensus was reached to finalize code assignments. Our final stage involved calculating the proportion of idea units for each category

and sub-category of topic and stance codes for each dimension, allowing for the identification of patterns of shifts in teachers' professional vision over time.

2.4 Findings

In this section, we first present findings from our analysis of overall shifts in teachers' professional vision from coaching cycles one to three, aggregated at the cycle-level to include both written and verbal reflections. We then situate these changes in excerpts of coach-teacher dialogues across cycles to illustrate how teachers' professional vision developed in this context.

2.4.1 Shifts in Teachers' Selective Attention

As shown in Table 5, the majority of teachers' reflections focused on their pedagogy across cycles, though there was a striking shift in what *specifically* teachers noticed about their pedagogy. In particular, as shown in Table 6, the proportion of teachers' pedagogy-related comments irrespective of students were nearly non-existent by the third coaching cycle (from 21% to 3%), while comments tied to specific student ideas more than doubled (from 22% to 53%; see Table 7 for results disaggregated by teacher). In other words, at the beginning of coaching, teachers had a more narrow focus on their actions; over time, they increasingly viewed their actions in relation to students' thinking. For example, during her first coaching cycle, one teacher commented: "I could have asked for more clarification but I kind of breezed through it and pushed it forward..." without elaborating how her actions influenced students' opportunities to think and engage with text.

Cycle-three reflections, in contrast, included more connections to specific student ideas. For example, during her third coaching cycle, this same teacher commented:

After Alex’s statement inferring Salva’s family works for the government ...that’s where I really should have stopped and pressed for clarification. Because at the end of that two minutes, I was the one who said: ‘I don’t think he’s working for the government, he’s kind of like a judge.’

Here, she reasoned about alternatives based on her interpretation of a specific misconception, suggesting closer attention to the interplay of her language choices, student ideas, and text.

Table 5 Teachers’ Selective Attention During Coaching Cycles 1 and 3

<u>Topic</u>	<u>Cycle 1</u>	<u>Cycle 3</u>
	n (%)	n (%)
Pedagogy	58 (64%)	62 (67%)
Student thinking	8 (9%)	17 (18%)
General Student Discussion/Participation	24 (26%)	11 (12%)
Classroom management	1 (1%)	2 (2%)
Total idea units	91	92

Note: Due to rounding, some percentage totals may not add up to exactly 100.

Table 6 Teachers’ Selective Attention Related to Pedagogy During Coaching Cycles 1 and 3

<u>Pedagogy</u>	<u>Cycle 1</u>	<u>Cycle 3</u>
	n (%)	n (%)
Not tied to students	12 (21%)	2 (3%)
Explicitly tied to students at a general, non-content specific level	33 (57%)	27 (44%)
Explicitly tied to students at a content-specific level	13 (22%)	33 (53%)
Total	58	62

Note: Due to rounding, some percentage totals may not add up to exactly 100.

Table 7 Percent Change in Frequency of Selective Attention Codes Across Cycles 1 to 3 for Individual Teachers

	<u>Teacher 1</u>	<u>Teacher 2</u>	<u>Teacher 3</u>	<u>Teacher 4</u>	<u>Teacher 5</u>	<u>Teacher 6</u>
Total idea units (n) per cycle [C1, C3]	[9,18]	[17,15]	[16,18]	[16,16]	[9,8]	[24,17]
<u>Selected Topic Codes*</u>						
Pedagogy- Not tied to students	-16%	-18%	-20%	-18%	-7%	-17%
Pedagogy- Explicitly tied to students at a content-specific level	+11%	+35%	+44%	+34%	-2%	+23%
Student thinking	+11%	+8%	+20%	+1%	-4%	-4%
General Student Discussion/ Participation	-27%	-16%	-9%	+7%	-18%	-18%

*Selective attention codes of focal interest for assessing meaningful developments in professional vision quality

*Gray-highlighted text indicates results aligned with the larger patterns of improvement observed across teachers

Table 5 also illustrates shifts in what teachers noticed about their students over time. In particular, attention to student thinking increased (9% to 18%) while comments related to general student discussion and participation concomitantly decreased (26% to 12%). During her first coaching cycle, for example, one teacher commented: “I thought it was a really good stopping point...Sam was just really going with it. Some kids were trying to speak but their voices weren’t very loud.” This reflection where the teacher focused on a student’s apparent excitement and the volume of students’ voices contrasts comments focused on students’ thinking about text specifics, as exemplified in the following cycle-three comment:

I’m wondering if it was her wording and not really her understanding of the text... maybe she was trying to say [the refugees] were so hungry right before they found the honey hive...not meaning so much further back [before the war] but maybe meaning just before they got to the hive.

Here, the teacher interprets a students’ apparent misconception about a group of refugees willing to risk injury to obtain honey because war had made food scarce, signaling close attention to the substance of students’ thinking about specific text content.

2.4.2 Shifts in Teachers’ Knowledge-based Reasoning

As shown in Table 8, our results also indicate shifts in how teachers reasoned about their videoed interactions over time. Specifically, the proportion of interpretive comments increased by over 20% from cycles one to three (55% to 78%), while evaluative comments decreased from 38% to 17% (see Table 9 for results disaggregated by teacher).

Table 8 Teachers’ Knowledge-based Reasoning During Coaching Cycles 1 and 3

<u>Stance</u>	<u>Cycle 1</u>	<u>Cycle 3</u>
	n (%)	n (%)
Interpretive	50 (55%)	72 (78%)
Surface	41 (82%)*	31 (43%)*
In-depth	9 (18%)*	41 (57%)*
Evaluative	35 (38%)	16 (17%)
Descriptive	6 (7%)	4 (4%)
Total idea units	91	92

Note: Due to rounding, some percentage totals may not add up to exactly 100.

*Proportion relative to total number of interpretive comments

Table 9 Percent Change in Frequency of Knowledge-based Reasoning Codes Across Cycles 1 to 3 for

Individual Teachers

<u>Selected Stance Codes*</u>	<u>Teacher 1</u>	<u>Teacher 2</u>	<u>Teacher 3</u>	<u>Teacher 4</u>	<u>Teacher 5</u>	<u>Teacher 6</u>
Interpretive	+9%	+28%	+31%	+25%	+11%	+27%
Interpretive-in depth	+13%	+44%	+38%	+27%	+15%	+69%
Evaluative	-18%	-22%	-31%	-6%	-14%	-21%

*Knowledge-based reasoning codes of focal interest for assessing meaningful developments in professional vision quality

* Gray-highlighted text indicates results aligned with the larger patterns of improvement observed across teachers

Most strikingly, our results indicate substantive change in the depth and specificity of teachers' interpretive reasoning. Specifically, 82% of teachers' cycle-one interpretive comments were surface-level, meaning they lacked reference to specific evidence of student learning and elaborated reasons in support of their assertions. For example, one teacher commented during her first cycle: "I think [students] were kind of agreeing with one another, taking on some of that responsibility themselves." While this suggests an interpretive stance, no attempt was made to support these inferences with elaborated reasons around specific evidence of student thinking. Indeed, only 18% of teachers' cycle-one interpretive comments exhibited an in-depth level of analysis. Over time, this proportion increased to 57%, while surface-level interpretations decreased to 43%. This suggests that, although teachers began the coaching already inclined towards interpretation (i.e., most cycle-one comments were interpretive), over time they grew their ability to marshal specific video evidence and provide elaborated explanation to support their inferences, as illustrated in the following cycle-three reflection:

Most kids came to that consensus, "Okay, he was taken by a lion." One student was adamant it had to be something else, "The blood doesn't really mean that there was a lion. Nobody saw it." It made me stop and think because before I probably would say, "No, the lion took him," but knowing what was coming up in the text I think helped, too, because I knew they needed more information, like the conversation Salva had with his uncle.

This signals a distinct shift not only in teachers' overall analytic stance, but also in sophistication of teachers' inferences over time.

2.4.3 A Closer Look at Shifts in Teachers' Professional Vision for Dialogic Text Discussion

To contextualize the results of our analyses showing overall shifts in teachers' professional vision, this section provides a deeper exploration of excerpts from cycle-one and cycle-three post-lesson conferences. Our goal is to provide greater insight into how teachers' professional vision emerged in this context and begin to explore how growth was fostered through coach-teacher dialogue. Illustrative examples from cycles one and three, where teachers were similarly challenged to deliberate facilitation moves for accountability to rigorous thinking, exemplify meaningful qualitative shifts observed across teachers.

Cycle-one excerpt.

The following shows a typical cycle-one conversation focused on supporting students to do more cognitive 'lift' in text discussions. Here, the coach had prompted the teacher to, using the Framework as a guide, form hypotheses about how alternative moves may have impacted students' thinking opportunities. In the clip, the teacher had posed an open-ended question ("What's happening now?") to students during a discussion around the short story, "Game of Catch" by Richard Wilbur. Although her goal was for students to make inferences about the social dynamics among three characters involved in a game of catch, students instead offered ideas about only one of the characters, Sko, without reference to the others (Monk and Glenny). The teacher then resorted to a series of low-inference advancing questions when students weren't immediately offering the 'right' answers. In her online reflective prompt, the coach had asked the teacher to consider how talk moves may have prompted students to think more deeply and broadly about the rich information they had learned. Excerpt 2 shows an excerpt from the subsequent post-lesson conference:

Table 10 Excerpt 2. Cycle 1 Coach-Teacher Dialogue (Post-Lesson)

Coach:	You were thinking they might have understood it better if you had asked, “How are Glenny and Monk reacting to his behavior?” Just that wording might have helped them?
Teacher:	Maybe just re-voicing it and rewording the question.
Coach:	You also said ‘I think I could have done a better job marking the text.’ I’m wondering what you meant by that.
Teacher:	I don’t know if I could have pointed something else out in the text that could have helped them to come up with it. I actually think they just didn’t understand the question.
Coach:	That’s possible.
Teacher:	I mean when I re-watch the clip, because they just look very blank to me...like they’re not sure what I’m asking them.
Coach:	If you reworded it to “How are they reacting to his behavior” you think they would have gone, “Oh, Okay.”
Teacher:	I think they might have understood that I wanted to know what those other characters were doing.
Coach:	Let’s say you asked [your original] question and you get that same blank look, and then you rephrase it ‘How are Glenny and Monk reacting to this behavior?’ So students know who you’re talking about, and you’re still getting blank looks?
Teacher:	That’s why I talk so much. I guess I would have to give them more advancing questions.
Coach:	That’s one option, asking more questions. But think about your top mission. What’s something you can do? So if you take a look at the [Framework], and we focus for now just on talk moves to support rigorous thinking, is there a particular talk move you might use that you think would be helpful in setting your students up to answer this question?
Teacher:	So maybe pressing for reasoning?
Coach:	They haven’t given an answer yet.

Though this teacher reflected on the influence of her pedagogy on students more generally, she did not consider how her suggested question (“How are Glenny and Monk reacting to his behavior?”) would shape opportunities for student thinking, as this amounts to yet another advancing question. Similarly, though she offered interpretations about what was happening (i.e., that students didn’t understand her original question), the evidence she provided (students’ blank faces) was not elaborated. Furthermore, when the coach prompted her to think about how her suggestion would influence students (“Let’s say you asked that...and you’re still getting blank looks?”), she adopted a narrower focus on pedagogy absent its influence on students’ thinking, and her reasoning became evaluative (“...I guess I would have to give them more advancing questions”). The coach responded by prompting her to think about her goal (supporting rigorous

thinking). Notably, the teacher suggested a talk move (“pressing for reasoning”) that, as the coach pointed out, did not make sense in this context (students would not have answered yet), signaling a lack of focus on students. This represents a pattern of reflection more typical for teachers at the start of coaching. Specifically, this teacher exhibited mixed attention to the influence of her pedagogy on students’ discussion participation more generally or with little regard to student thinking, and her reasoning tended to be surface-level interpretative or evaluative in nature.

2.4.3.1 Cycle-three excerpt.

This cycle-three excerpt highlights a discussion where coach and teacher are similarly reflecting on facilitation moves for accountability to rigorous thinking. In contrast to the previous excerpt, however, this interaction demonstrates a stronger focus on pedagogy in connection to specific student ideas and lines of thinking and in-depth reasoning about this relationship. Here, coach and teacher were conferring around a video clip of a discussion of the novel “A Long Walk to Water” by Linda Sue Park. In the clip, the teacher had posed an open-ended question to students (“What’s going on here?”) after discussing multiple text events, including a dilemma wherein one of the main characters (Nya) and her family deliberate whether to risk a journey to get medicine for her sister (Akeer), who may die without the medicine, but who may also die from numerous perils on the road. They also discussed how several student misconceptions influenced the trajectory of the discussion. One particular misconception arose from students confusing storylines in the novel, specifically, conflicts between ethnic groups (Dinka vs. Nuer tribes) and governing factions (Muslim-led government vs. Christian-led rebels) in South Sudan. In her online written reflection, the teacher generated some ideas for how to push students to think more specifically about Nya’s dilemma and clear up some misconceptions. Excerpt 3 shows an excerpt from the subsequent post-lesson conference:

Table 11 Excerpt 3. Cycle 3 Coach-Teacher Dialogue (Post-Lesson)

Teacher:	I think if I had nipped it in the bud when Pedro gave his two options and we had focused the discussion on those two, throwing it back to the kids, "Okay, he gave us two options. What do you think about these two options?" I think it would have eliminated some of the more abstract ideas they were reaching for to come up with more reasons, and would have refocused them on which choice the family would make.
Coach:	I don't know if Pedro is actually giving them two options to consider, because those are the two options the family had to think about. Right?
Teacher:	Right. He gave the two that we were looking for. I think in asking if anybody had anything else, they were then reaching for reasons they wouldn't take the walk or would be worried to stay home. I feel they were trying to find proof for things that really weren't there, if that makes sense.
Coach:	I do understand what you're saying. I guess the question here is: what else in the text was there for them to discuss, besides [Nya's] dilemma?

Coach and teacher then discuss the relevance of other student ideas, including contributions that may seem more disconnected or misconceived:

Table 12 Excerpt 3, cont'd

Coach:	But I'm thinking they had some important misconceptions. Like, if they stay at camp, their uncle is chief and they might get attacked. That's a really interesting thing that student said. So that might have needed exploring. Then the last student was saying – about not keeping Akeer with mom at camp, because the Dinka and Nuer are fighting over water supplies. So they're very concerned about this Dinka-Nuer warfare.
Teacher:	The fight, right.
Coach:	Even though there hasn't been any Dinka and Nuer fighting in the text thus far.
Teacher:	I think that's because Salva's story revolves around the fighting.
Coach:	Right, but it's not the Dinka and Nuer fighting.
Teacher:	No. I don't think they've made that distinction.
Coach:	Yeah. That's a really important thing to note. Even though the only fighting that's happening is between the government and rebels, there is history of the Dinka and Nuer having problems.
Teacher:	And I think for [the students], Dinka and Nuer is one tribe against the other, whereas I think the rebels against the government is a much more abstract idea for them. My kids are inner-city kids. They get one gang fighting against another gang, but the idea of fighting against the government I think is much more abstract for them.

Notably, though the coach used similar strategies to push teachers' thinking (e.g., orienting the teacher to consider multiple potential lines thinking: "...what else in the text was there for them to discuss, besides [Nya's] dilemma?), clear differences in the quality of teachers' reflections were evident across cycles. It is interesting to note, for example, the contrast between reflections on

alternative facilitation moves in the beginning of this excerpt and the previous excerpt showing a similar conversation in cycle-one. Unlike the cycle-one excerpt, this teacher reflected on her goals for students' learning and evidence of students' thinking in video, and made inferences about the influence of alternative moves based on her interpretations (e.g., "I think if I had nipped it in the bud when Pedro gave his two options..."). Moreover, when the coach raised a particular misconception as a worthy object of inquiry, the teacher made multiple inferences about the genesis of this line of thinking, drawing on evidence from the text itself ("...because Salva's story revolves around fighting") as well as in connection to students' background knowledge ("They get one gang fighting against another... but [this] idea...is much more abstract for them.") This more selective focus on, and in-depth reasoning about, pedagogy in relation to specific evidence of student thinking exemplifies the larger transformation we observed across teachers as they participated in these coaching dialogues over time.

2.5 Discussion

Recent decades have seen a strong impetus for practice-based teacher learning programs that are anchored in robust theories of learning and specify empirically testable mechanisms of change (Desimone, 2009; Berson et al., 2015). Reflection is one such key mechanism, and growing access to high-quality video has created unparalleled opportunities to engage teachers in rigorous learning throughout their careers. In tandem with these developments is the proliferation of research suggesting the critical role of dialogic classroom interactions for facilitating robust student learning (Resnick et al., 2010; Wells & Arauz, 2006; Fishman et al., 2017). As researchers working in multiple countries have found, learning to facilitate these discussions poses a

significant challenge for teachers. In addition to learning an array of new discourse moves, teachers must also learn how to identify and flexibly adapt their instruction to grow students' thinking in discussion.

As mentioned, reflection as a mechanism for developing new pedagogical insights has been richly elaborated on a theoretical level but lacks consistent definition and systematic investigation on the empirical level, especially in the area of literacy instruction. Studying how teachers' reflective practice develops in relation to specific instructional orientations and professional learning models is, however, critical for advancing our collective knowledge of how to support teacher learning. Moreover, identifying the critical mechanisms, or the kinds of change in teachers' thinking that would support desired changes in practice, is essential for the design of professional development that can more precisely cultivate these mechanisms.

For our intervention context, we proposed that developing teachers' reflection on the link between their facilitation moves and the rigor of students' thinking in their classroom videos would be a key function of the coaching for cultivating teachers' dialogic facilitation skills in practice. Drawing on a professional vision analytic lens, we identified meaningful shifts in how teachers noticed and made sense of their classroom interactions in this context- in particular, an increased focus on the specifics of discussion choices in relation to students' thinking about text and an increased tendency to interpret these interactions using in-depth reasoning and specific video evidence. We interpret our results to suggest that our professional vision framework or approach to characterizing reflective practice can reliably capture meaningful developments in teachers' learning of dialogic text discussions.

Notably, though our findings bear resemblance to other research examining in-service teachers' professional vision, our data also suggest some distinct patterns. For example, much prior

research has emphasized teachers shifting attention from teacher actions to student thinking and becoming more interpretive and less evaluative in their reasoning over time. While our data suggested similar shifts, the most notable changes for our teachers were in how they viewed their pedagogical moves in relation to students' thinking and the quality of their interpretations of this relationship. In particular, our finer-grain analyses of changes in what teachers *specifically* notice about their pedagogy (i.e., alone or in connection to students at varying levels of specificity) as well as the depth and specificity of the inferences they draw from their analysis (i.e., surface-level vs. in-depth) captured developments in teachers' thinking that would be especially meaningful for their practice this context. We believe, for example, that teachers' capacity to make skillful facilitation choices entails not only learning to adopt an interpretive stance but also how to make more sophisticated inferences about the rigor of students' learning - i.e., by using evidence of student thinking and elaborations of their knowledge of the instructional context (e.g., gauging students' contributions in relation to the 'big ideas' in a text). Similarly, we conjecture it is not only important for teachers to attend to students' thinking, but perhaps more critically, how the specifics of their discussion moves (e.g., the phrasing of a question) shape the thinking opportunities available to students. Hence, incorporating these sub-codes in analyses of reflective dialogues could be particularly fruitful for efforts to understand developments in teachers' learning of dialogic text discussion.

Importantly, the ways in which video is employed to develop teachers' reflective practice should be strongly informed by pedagogical goals and orientations (Gaudin & Chaliès, 2015; Blomberg, Sherin, Renkl, Glogger, & Seidel, 2013). Our coaching model has a distinct approach that positions the coach primarily as a facilitator of teachers' sense-making, towards the goal of having teachers critically analyze students' thinking and their own role as a facilitator of students'

thinking. This diverges from the standard script for many instructional coaching interactions that primarily aim to give feedback on teachers' progress and assist in planning instructional goals and lessons. Notably, our approach is well-aligned for this *particular* type of reading instruction- developing reading comprehension through dialogic text discussion- where teachers' ability to notice and facilitate students' critical-analytic thinking about text meaning is paramount. Other approaches to facilitating teachers' reflections that includes more, for example, direct feedback on how well they implemented a module for phonics instruction or cultivated a positive climate, may be more appropriate according to the instructional context.

The implications of this study should therefore be interpreted within the context of the design, aims, and scope of this project. Additional considerations include the fact that our sample teachers were motivated to learn this instructional model and dedicated the necessary time to complete this intensive intervention. As such, our findings may not generalize to other teachers and coaching contexts. However, as our goal was to explore a method for characterizing and examining changes in teachers' thinking about classroom text discussions, we believe this work contributes insights that can be leveraged and studied with larger samples.

It is also noteworthy that our teachers had extensive work building their content knowledge in a six-week workshop prior to coaching, which we suspect was important for supporting productive joint-reflection. This may help explain, for example, why our teachers were mostly interpretive from the start of coaching, diverging from other studies suggesting teachers' initial stances are often more evaluative or descriptive (e.g., Sherin & van Es, 2009). Importantly, as captured by our sub-code analyses, these interpretations were almost entirely surface-level but grew in substance over time- suggesting a potentially important role for prior knowledge-building in positioning teachers to reflect more productively from the start of coaching.

We would also emphasize that, in line with some research exploring variation in teachers' professional vision in math and science (e.g., van Es 2008; Sturmer et al., 2016), the improvements we observed across

teachers was not entirely monolithic (see Tables 7 and 9). Though beyond the scope of this study, individual differences would be a critical focus for future work, including exploring the relationship between professional vision and other key factors (e.g., teacher beliefs/epistemologies, prior knowledge) that could impact the quality of teachers' learning and reflective engagement.

Moreover, though we aimed to provide some insight through the coaching dialogue excerpts, it was beyond our scope to systematically analyze the coach's role in facilitating teachers' reflections. A more thorough investigation of how specific coach discourse moves, and sequencing of moves, facilitates teachers' professional vision growth is warranted. Another intriguing avenue would be to consider how professional vision could be leveraged to inform learning and/or formative assessment tools for coaches and teachers. Coaches might, for example, use a professional vision framework to gauge how teachers' reflections are developing and use this to inform their sessions (e.g., integrating more explicit supports to cultivate an interpretive stance if a teacher is especially evaluative). Coaches may also make professional vision more explicit to teachers as a central feature of their practice by, for example, having teachers label their teaching moves (i.e., posing questions such as: "What did your response indicate about your noticing in that moment? What cues from students factored into your interpretation of their learning that led to your response?"). Our hope is that this study can be a foundation for further exploration of how professional vision can be leveraged to inform and guide the dynamic work of video-based reflective coaching.

In sum, we believe this work offers important contributions to research on how teachers learn dialogic classroom discussion practices through coach-guided video reflection, as well as how teachers' professional learning can be characterized and assessed in this context. As such, we believe professional vision offers a compelling frame for analyzing an especially critical facet of teachers' learning in relation to the goals of dialogic text discussions. As interest in video-based professional development to implement dialogic pedagogical approaches continues to proliferate, it is vital that empirical work to understand how teachers learn to transform their discussion

practices keeps pace. These efforts are paramount for advancing our collective work to increase access to rich learning opportunities for students across classrooms, schools and countries.

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3.0 Study 2: A Case Study Exploration of the Relationship Between Teacher Reflection and Classroom Text Discussion Quality in a Video-Based Literacy Coaching Intervention

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Abstract

Dialogic text discussions are critical to achieving ambitious reading comprehension goals in 4th and 5th grade classrooms. A wealth of research across international contexts shows, however, that shifting patterns of classroom discourse is exceedingly difficult. In this study, we conducted an in-depth comparative case study of two teachers' learning trajectories as they participated in iterative cycles lesson planning, video reflection, and experimentation as part of a remote literacy coaching intervention, Online Content-Focused Coaching (Online CFC). We specifically examined the relationship between the quality of teachers' reflections in dialogues with an expert coach and the extent of growth in the quality of their text discussion practices and student discussion contributions over time. To do this, we developed an integrated set of analytic frameworks to examine teacher learning processes in connection to conceptually linked dimensions of text discussion quality. Findings suggest a link between the quality of teachers' *professional vision* in coaching reflections and improved use of dialogic 'talk moves' to create space for student ideas and facilitate more rigorous student thinking and reasoning processes in text discussion. Our analyses also revealed potential factors for explaining meaningful patterns of variation in teachers' reflection and practice trajectories. Most notably, findings suggest the influential role of adopting a stance of critical inquiry in reflection and the countervailing influence of tacit beliefs and entrenched practices related to implicit assumptions about the nature of student

ability and learning needs. We discuss the implications of these findings for teacher learning theory and professional development research and design.

3.1 Introduction

Motivated by theory and research foregrounding the critical role of discourse in concept development (e.g., Vygotsky, 1978; Wertsch, 1991), recent decades have seen considerable momentum towards implementing dialogic or “student-centered” instructional paradigms across the content areas (Franke, et al., 2009; Murphy, et al., 2009; Wilkinson, Murphy, & Binici, 2015). Research in literacy instruction in specific shows that dialogic whole-class text discussions are critical for growing students’ analytic thinking and reading comprehension skills (Matsumura, Garnier & Spybrook, 2013; Correnti et al, 2020; Anderson, Chinn, Waggoner, & Nguyen, 1998; Murphy et al., 2018; Wilkinson, et al., 2009). While a variety of models for dialogic literacy instruction have developed over the years that emphasize diverse pedagogical aims (e.g., argumentation, critical-analytic thinking, and exploratory talk), shared among these models is an instructional vision that situates student thinking at the heart of classroom activity. Teachers are intended to create dialogic ‘space’ for students in discussions to air their emergent thinking about concepts and ideas (e.g., posing an open-ended question or problem statement for students to consider and explore) and nurture students’ individual and collective thinking by marking and exploring differing interpretations, and probing students to explain their thinking and reasoning (Kucan, 2009; Clarke, Howley, Resnick, & Rose, 2016). The key idea is that all students are positioned as capable participants in meaning-making processes and authentic drivers of classroom activity (Alexander, 2006; Lehesvuori, 2013; Soter et al, 2008).

Research across international contexts shows, however, that dialogic discussions are exceedingly rare. Instead, classroom discussions most often follow monologic or ‘recitation’ patterns of discourse that typically provide little to no opportunity for students to engage in active meaning-making and exploration of ideas (Applebee et al., 2003; Mehan, 1979; Cazden, 2001). These traditional discussions are characterized by efforts to “check” students’ comprehension by teachers asking close-ended questions text (i.e., “who, what, when, where” questions) that target easily inferred or retrieved factual information, and students providing short (often less than a sentence-length) responses. This approach to classroom discussion is ‘teacher-centered’ in that the teacher assumes the role of ‘interpretive authority’ and students’ learning is narrowly defined and evaluated relative to preordained standards of “correctness.” This is problematic because when teachers over-utilize these questioning practices, they remove opportunities for students to engage in the inferential work essential for building independent reading comprehension and critical thinking skills.

Allocating interpretive authority to students represents a radical shift in traditional thinking about the nature of knowledge, learning, and power in the classroom, posing a fundamental challenge to teachers’ experiences and beliefs about students’ capability and learning (Buehl & Fives, 2016; Snell & Lefstein, 2018; Fives, Barnes, Buehl, Mascadri, & Ziegler, 2017). Indeed, even when teachers adopt practices that are, at first glance, characteristic of dialogic practice (e.g., asking open-ended questions and pressing students to explain their thinking), they often still do not engage students’ thinking in substantive ways (Correnti et al., 2020; Sedova, Sedlacek, & Svaricek, 2016). Thus, learning to facilitate dialogic text discussions calls for teachers to reflect on their embedded pedagogical assumptions and shift their thinking about the nature of classroom teaching and learning, in addition to learning new facilitation skills. Absent reflective skills that

enable teachers to develop a more nuanced understanding of their discussion moves in connection to the underlying goals of dialogic text discussion, efforts to make substantive changes in classroom discussion practices will likely be unsuccessful (Walsh et al., 2020; Zook-Howell et al., 2020).

A growing body of evidence suggests that engaging teachers in ongoing cycles of practice-based reflection and experimentation can be a powerful context for transforming teaching practice (Borko, 2008; Sherin & van Es, 2009; Gaudin & Chalies, 2015). Classroom video, when integrated into skillfully procured and facilitated formats for reflection (e.g., coach-guided synchronous and asynchronous reflective dialogues) is an especially potent learning artifact, as it captures meaningful pedagogical challenges and classroom interactions their full complexity. This provides a context for engaging teachers' critical-analytic thinking and reasoning about the effects of their minute-to-minute pedagogical choices on students' thinking opportunities – a key reflective skill for making more informed and responsive choices in the midst of instruction (Sherin & Han, 2004; Walsh et al., 2020; Zook-Howell et al., 2020). Together with opportunities to 'try out' new insights in their subsequent lessons, this creates a powerful cycle where teachers learn to observe and analyze developments in their practice over time- establishing a 'reflective practitioner' disposition that enables teachers to continually learn from their practice (Dewey, Rodgers).

Although reflection is generally understood to be essential for teachers' ongoing learning, and considerable progress has been made to advance 'high-leverage' reflection-based design principles and activities (Desimone, 2009; Kennedy, 2016), how reflection processes specifically relate to changes in teacher thinking and practice is not systematically understood (Beauchamp, 2015; Gaudin & Chalies, 2015). This issue is embodied by the fact that, though efforts to develop effective reflection-based professional development have flourished amidst the rise of dialogic and

‘student-centered’ instructional models, there is still considerable variation in teacher learning outcomes both within and across programs. One explanation for this is represented by the ‘black box’ problem in teacher intervention research that has resulted from a general lack of robust efforts to theorize and study the learning processes and mechanisms that lead to substantive change in teaching practice. Especially missing is theory-based empirical work to understand how teachers’ reflection on classroom video enables positive change in students’ thinking opportunities in practice, particularly in the context of reading comprehension instruction (Shanahan, Tochelli-Ward, & Rinker, 2015; Major & Watson, 2018)⁴.

In the current qualitative study, we address this gap in the extant research by drawing on a ‘professional vision’ framework (Sherin & van Es, 2009) to explore the relationship between teachers’ learning processes in the context of a video-based coaching program and changes in the nature of their classroom text discussions over time. We specifically employ a comparative case study design to investigate, at a micro-interactional level, the learning and practice trajectories of two teachers engaged in sustained reflective dialogues with an expert coach around videos of their classroom lessons. Guided by a professional vision framework, we offer a conceptually-aligned approach to analyzing teachers’ in situ learning processes (i.e., reflection-on-action) in connection to specific changes in their practice (i.e., reflection-in-action) centered on teachers’ noticing and facilitation of students’ thinking opportunities in their classroom discussions. Through this, we aim to contribute to a theory of teacher change in this context that connects teacher learning processes, practice outcomes, and student learning as evidenced by measures of student discussion

⁴ Though important exceptions do exist (see, e.g., Arya, Christ, & Chiu, 2014; 2015; Osipova et al., 2011; Shanahan & Tochelli, 2014).

quality. This final indicator, student discussion quality, is an especially key feature of this study as student discussion is rarely assessed beyond rough frequency counts (Sedova et al., 2016). As we will argue, it is essential for researchers to go beyond simple ‘counts’ in assessing discussion quality as students can be actively engaged but in a superficial, non-dialogic manner not conducive to effective learning (Lefstein et al., 2015). Finally, our comparative case study design enables an exploration of potential factors to explain how and why teachers may vary so widely in their learning processes and outcomes. Our hope is that the analytic approach and findings of the present study will help guide future research and hypothesis testing to advance a more robust theoretical and empirical base of teacher learning and change processes research.

3.2 Theoretical Framework

3.2.1 Theory and Research on the Role of Reflection to Advance Dialogic Teaching Practice

Research on teachers’ reflective practice traces back to the seminal work of philosopher John Dewey who defined reflection as an exercise in purpose-driven inquiry to critically examine one’s beliefs and practices, towards the goal of “learning to take intelligent action” (Dewey, 1933; in Rodgers, 2002b, p. 249). Importantly, this pre-supposes a state of mind grounded in ‘perplexity,’ a recognition that one’s pedagogical beliefs and practices are worthy of re-examination and possibly alteration. As a professional learning activity, reflection should therefore enable teachers to problematize and interrogate teaching practices that may have become routine or rote (Rodgers, 2002a; Loughran, 2002) and generate “working hypotheses” about the influence of alternative actions that can be instantiated in future lessons.

Schon's influential (1983; 1987) work further expounded the critical link between reflection and action by demonstrating how teachers' learning in a professional development context (i.e., reflection-on-action) can lead to more responsive and informed teaching practices in their classrooms (reflection-in-action). These reflective processes iteratively inform change in teachers' thinking and practice over time. Specifically, during reflection-on-action, a teacher decomposes and analyzes elements of a teaching situation either before or after it occurs. As teachers engage in reflection-on-action over time, they discover rich and novel details about their practice - paving the way for more considered responses in their classrooms as they make sense of students' learning (reflection-in-action) in the moment of instruction (Rodgers, 2002a,b; Borko et al, 2008; Sherin & Han, 2004; Sedova, 2016).

Finally, mirroring insights from situated learning theory, reflection as a means for building teaching expertise is not a process that occurs in isolation; it is mediated through social interaction (Rodgers, 2002a; Greeno, Collins, & Resnick, 1996). Research on effective practice-based learning experiences for teachers has similarly emphasized the role of interactive dialogue that is, importantly, anchored in artifacts of teachers' own classrooms (Ball & Cohen, 1999; Darling-Hammond, 2008; Putnam & Borko, 2000). Guidance or facilitation from one or more "expert others" is also key for assisting less experienced or knowledgeable colleagues in building knowledge, making informed inferences, and drawing new insights that can be tested (Vygotsky, 1986; Rodgers, 2002a; Marsh & Mitchell, 2014). As such, reflective activities should ideally be anchored in real classroom artifacts that provide plenty of grist for teachers to engage in critical dialogue around their instructional choices and goals for student learning.

Video of classroom lessons is, arguably, an ideal artifact for building teachers' reflective practice (Brophy, 2004; Borko et al., 2008; Sherin & Han, 2004). Leveraging classroom video is

powerful because it situates teachers' learning in a meaningful and authentic context (Putnam & Borko, 2000; Borko et al., 2008; Seidel, et al., 2011), depicts concrete evidence of cause-effect relationships between teaching and learning, and conveys the complexity of real classroom interactions while allowing teachers to deliberate and reflect in ways that can lead to new insights (Brophy, 2004; Sherin, 2004). Many researchers have emphasized that leveraging video from teachers' own classrooms can be especially powerful, as it conveys meaningful interactions that connect to teachers' larger goals for themselves and their students (Borko et al., 2008) and can promote stronger links between teachers' learning in a professional learning context (e.g., new instructional concepts and insights gained through reflection) and instantiated changes in their classrooms (Osborne et al., 2019, Sedova, 2017). Furthermore, when video of teachers' own instruction is utilized, it can create dissonance between what teachers remember of their classrooms and what they observe on video –offering a productive lens for teachers to analyze their classroom interactions from new perspectives (Harlin, 2014).

Importantly, as is the case with reflection more generally, teachers do not learn from simply viewing video; rather, video must be integrated into purposefully facilitated contexts that induce productive modes of inquiry and encourage “reflection, analysis, and consideration of alternative pedagogical strategies in the context of a shared common experience” (Borko, et al., 2008, p. 419). Hence, many researchers have emphasized the central role of an expert facilitator, often in conjunction with other kinds of supports (e.g., reflection guides and protocols) to scaffold teachers' video reflections and guide their analysis and discussion (van Es, Tunney, Goldsmith & Seago, 2014; van Es, 2011). Moreover, because teachers' prevailing conceptions of effective teaching and learning will likely influence what they attend to in video and how they interpret these events (Borko et al., 2011), it is critical that a shared model for effective pedagogy is also established.

This is particularly the case when teachers are learning student-centered instructional approaches, such as dialogic text discussions, that run counter to traditional pedagogical beliefs and practices.

A growing body of research suggests that video-based professional development can be effective for increasing the quality of teachers' classroom discussions (Matsumura et al., 2019; Correnti et al., 2020; Berson et al., 2015; Chinn, Anderson & Waggoner, 2001; Fishman et al., 2017; Kiemer, Groschner, Pehmer & Seidel, 2015; Murphy et al., 2018; Sedova et al., 2016). This is especially the case when formal learning (e.g., workshops) is paired with ongoing opportunities for teachers to iteratively refine their practice through reflection and experimentation (e.g. through personalized coaching or group-level discussions). Murphy et al. (2018), for example, found that a year-long implementation of a professional development program (Quality Talk) that included workshops to develop teachers' knowledge followed by personalized "discourse coaching sessions" around teachers' videoed lessons, showed significant improvements in teachers' use of dialogic questions and students' use of elaborated explanations and exploratory talk during their discussions. Research around another program, the Dialogic Video Cycle (DVC), has demonstrated the benefits of video reflection in particular for increasing teachers' use of dialogic discussion practices in a whole-class discussion format, including open-ended questions and rejoinders that fostered students' knowledge elaboration, effects that were not observed for teachers in a workshop-only comparison group (Kiemer et al., 2015).

Notably, other studies focused on video-based professional development have shown more mixed or negative results on the quality of teachers' classroom discussion practices (e.g., Osborne et al., 2019). One explanation for why programs sometimes show disappointing results is that while reflection in general (and video reflection in particular) is widely regarded as a critical component of teachers' ongoing professional learning, reflective activities can lack a clear connection to

content- or discipline-specific learning goals or a coherent theory of teacher learning (Beauchamp, 2015). Moreover, significant variation can exist in the dissemination or facilitation of even well-specified reflective activities, leading to a variation in teacher learning outcomes that often goes unexplored (Ibid.). This speaks to the larger need for research to go beyond the identification of key design elements or ‘essential features’ (Desimone, 2009) to specify and examine proposed learning mechanisms and outcomes in connection to specific theories of change, a relatively rare but critical endeavor for advancing the field of teacher learning (Grossman Smagorinsky, & Valencia, 1999; Kennedy, 2016; Thompson et al., 2013). An important component of this effort involves the identification of a conceptual framework or lens that can be leveraged in the conceptualization and assessment of teacher learning mechanisms and outcomes. This enables a more rigorous and comprehensive study of teacher learning in connection to targeted pedagogical principles and goals for change in practice.

3.2.2 Professional Vision as a Conceptual Framework for Practice-based Reflection

Professional vision (Goodwin, 1994), often referred to as ‘teacher ‘noticing’ in education research, is one such a framework for assessing and guiding reflection on video artifacts to advance dialogic (or ‘student-centered) classroom practices in a discipline. To date, this work has largely been advanced in the context of student-centered math and science instruction, as a way to center teachers’ professional learning on identifying and nurturing students’ thinking about math and science concepts (e.g., Colestock & Sherin, 2009; Jacobs, Lamb, & Philipp, 2010; Dyer & Sherin, 2016; Marsh & Mitchell, 2014; Rosaen et al., 2008; Sherin & van Es, 2005; 2009; Tekkumru Kisa & Stein, 2014; van Es & Sherin, 2008). Though variations in definition exist, professional vision in the context of teaching can be described in terms of the interrelated processes of selective

attention, or selectively attending to ‘significant’ classroom features, and knowledge-based reasoning, or interpreting those features based on professional and contextual knowledge (Blomberg, Sturmer, & Seidel, 2011; Sherin, 2007; Sherin & van Es, 2009). A third process, deciding how to respond on the basis of students’ understanding of instructional content, has also been widely integrated into frameworks describing teachers’ professional vision in the context of reform math pedagogy (Jacobs, Lamb, & Phillip, 2010).

Because student-centered pedagogies emphasize student thinking as the primary driver of instruction, researchers have emphasized teachers’ learning to “notice ambitiously” (Louie, 2019), such that they are able to identify, interpret, and flexibly respond to their ‘read’ of students’ thinking and learning progressions in the midst of instruction (Jacobs, Lamb, & Phillip, 2010). As we noted earlier, this poses a new challenge for teachers accustomed to the precepts and interactional ‘scripts’ that center teachers as purveyors of instructional content and evaluators of the expository ‘correctness’ of student contributions (Louie, 2019; Tekkumru-Kisa & Stein, 2014). Indeed, research indicates that teachers often struggle to attend to the substance of students’ thinking (e.g., the coherence of their ideas or quality of their reasoning) or the specifics of their conceptual understanding, and instead focus on the accuracy of students’ answers or how students are procedurally engaged with a task (Santagata, 2011; Sherin & Han, 2004; van Es & Sherin, 2010).

In addition to what teachers notice, they must also interpret those events in ways that can be leveraged to develop students’ thinking. Teachers frequently are evaluative or descriptive in their reasoning about the classroom features they notice and discuss- rather than attempting to analyze or interpret these features based on evidence of student learning (Sherin & van Es, 2009). Adopting an interpretive lens, in contrast, enables teachers to draw new insights from their

interactions with students and use these to adapt their pedagogy in response to students' thinking in the moment of instruction (Sherin & van Es, 2009). A key goal has therefore been to support teachers to learn how to focus more selectively on students' thinking when viewing videoed lessons, and perhaps even more critically, to interpret the connection between their instructional choices and students' opportunities to engage in rigorous thinking.

To date, much of the research on developing teachers' noticing has been conducted in the context of video clubs, where groups of teachers meet to analyze and discuss videos of one another's lessons with guidance from an expert "facilitator"⁵ (e.g., van Es & Sherin, 2008; Sherin & van Es, 2009). The facilitator plays a critical role in structuring and guiding these discussions in ways that develop teachers' professional vision by, for example, selecting video clips that make students' thinking visible for discussion, guiding teachers' reflections to focus on student learning and interpreting students' thinking as evidenced in the video, and modeling how to reason about classroom interactions using video evidence (Goldsmith, & Seago, 2014). Several studies have shown that as teachers participate in video clubs they become increasingly focused on students' thinking in their classroom videos and their reasoning becomes more interpretive over time (e.g., Sherin & van Es, 2009; van Es & Sherin, 2008; van Es & Sherin, 2006; Walkoe, 2015). This represents a substantial shift from what is observed in early discussions, where teachers focus more narrowly on teaching moves (not in connection to students) and their reasoning about video tends to be more descriptive (i.e., simple restatements of video events) or evaluative (i.e., making

⁵ Though other designs do exist (see, for example, Tekkumru Kisa & Stein, 2014; Borko et al., 2011). Moreover, though our focus is in-service teacher learning, many studies also explore pre-service teachers' noticing or professional vision (see, for example, Barnhart & van Es, 2015; Rosaen et al., 2008; Star, Lynch, & Perova, 2011)

surface-level judgments about what was good or bad). Developing teachers' professional vision or noticing in a professional learning context also has been associated with increased responsiveness to students' thinking processes during instruction - providing evidence for the link between the reflective skills teachers develop as they reflect on video and improved skill for making sense of students' thinking in practice (Dyer & Sherin, 2016; van Es & Sherin, 2010). van Es & Sherin (2010), for example, in their analysis of selected teachers' videos from early and late stages of a video club discussion group, found increased acknowledgement and uptake of student ideas in teachers' classrooms over time, mirroring the developments observed in teachers' reflective video discussions. As is the case with most research in this area, however, this study did not examine whether any changes occurred in the nature of students' contributions in the classroom, leaving silent the question of whether these changes in teachers' practices had any appreciable benefit to the quality of students' contributions – their thinking expressed in discussions.

In sum, although an increasing number of studies have examined the effects of video-based professional development on various teaching and learning outcomes, relatively little research has analyzed how the quality of teachers' reflections around video develops or relates to changes in the quality of their classroom practices (Gaudin & Chalies, 2015; Sedova et al., 2017; Tripp & Rich, 2012), and this is especially the case in the context of implementing dialogic classroom discussions (with some important exceptions; see Sedova, 2017). This is reflected in the “black box” problem of teachers' professional learning more generally- i.e., relatively little robust theoretical or empirical research has developed towards understanding the mechanisms of teachers' learning across content and professional development contexts (see e.g., Kennedy, 2016; Munter & Correnti, 2017; Osborne et al., 2019; Thompson et al., 2013).

3.3 Present Study

3.3.1 Study Context

Our study is situated within a larger three-year study to develop and test an online version of a successful literacy-coaching program (Content-Focused Coaching, CFC) developed at the Institute for Learning (IFL), a scholar-practitioner research institute located at the University of Pittsburgh (Matsumura et al., 2012; 2013). Online CFC is comprised of an online workshop (see Matsumura et al., 2019 for details about the design of the workshop) followed by individualized, video-based coaching cycles to support teachers' ongoing facilitation of dialogic text discussions in their 4th and 5th grade classrooms. The instructional model featured in Online CFC integrates Questioning the Author (QtA) (Beck & McKeown, 2006) and Accountable Talk (Michaels, O'Connor, & Resnick, 2008) techniques for facilitating dialogic classroom text discussions. Together these approaches support students to construct a mental representation of situations described in a text (e.g., Kintsch & van Dijk, 1978), and build critical-analytic thinking skills by marking and exploring differing interpretations, encouraging students to explain their reasoning with evidence, and supporting students to link their ideas to other students' contributions and to larger text themes. The key principles and associated teacher and student talk 'moves' of QtA and Accountable Talk are summarized in a document termed the Framework for Effective Text Discussions ('the Framework') (see Appendix A) that all teachers receive in advance of the coaching phase. The Framework serves as an important tool for anchoring teachers' coaching conversations in a shared language or 'vision,' allowing for productive joint analysis of teachers' videoed classroom interactions relative to dialogic discussion principles and goals.

The coaching model, which features iterative cycles of planning, reflection, and experimentation, centers on eliciting and scaffolding teachers' critical thinking and reasoning around key teaching-learning moments captured in their classroom videos. Anchored in cognitive apprenticeship theory (Collins, Brown, & Holum, 1991), the goal is to develop teachers' conceptual and practical knowledge by guiding them to interpret their videoed discussion interactions through the lens of the text discussion model and hypothesize the effects of alternative talk moves for future lessons. This is achieved through sustained cycles of lesson planning and goal setting (Phase 1) followed by both asynchronous written reflections (Phase 2) as well as synchronous verbal reflective dialogues to jointly analyze teachers' videoed lesson (Phase 3) (see Figure 1).

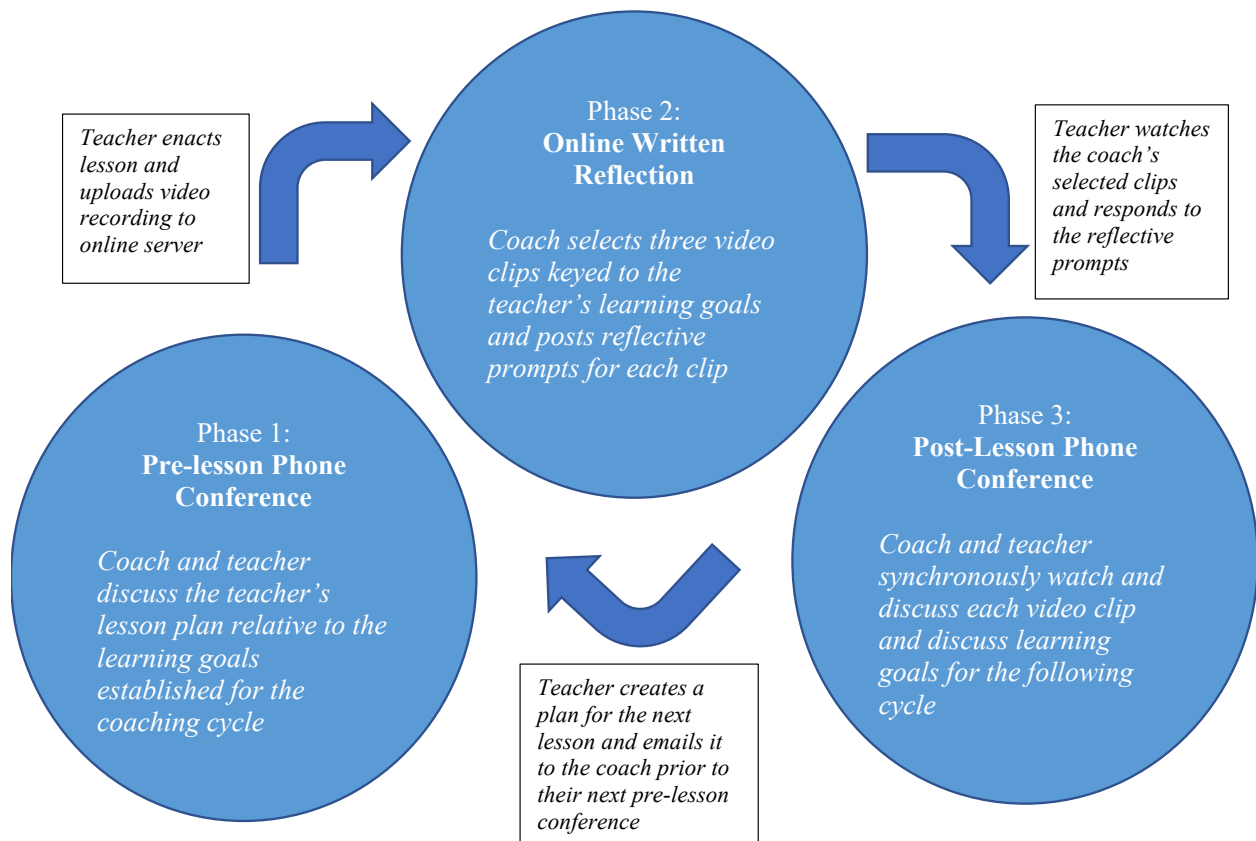


Figure 1 Online Content-Focused Coaching Cycle Components

As shown in Figure 1, each coaching cycle commences with a pre-lesson phone conference to discuss the teachers' upcoming lesson plan (emailed to the coach prior to the conference) through the lens of the teacher's selected learning goals (i.e., 2-3 dimensions of the Framework, see Appendix A). For Phase 2, the coach selects and uploads clips from the teacher's video recorded lesson onto a shared online server (the Online Coaching Interface developed at the University of Virginia's Center for Advanced Study of Teacher Learning or CASTL). For each video clip the coach writes a reflective question for to draw teachers' attention to the impact of their discussion choices on student thinking (i.e., the quality of students' responses to a posed question). Teachers' written responses to these questions set the foundation for the subsequent post-lesson conference in which the coach and teacher synchronously watch and discuss each video clip (see Zook-Howell et al., 2020)

Results of our previous research showed that over the course of teachers' participation in the coaching intervention (approx. 3-5 coaching cycles per teacher, 1 cycle per month) teachers increased in the frequency of their use of talk moves characteristic of dialogic teaching (e.g., open-ended questions, asking students to explain their thinking, inviting students to respond to each other), as well as their ability to use talk moves productively to make space for student voice in discussion and grow their ideas. This was evidenced in increases in the overall quality of students' thinking and reasoning in discussion for three different cohorts of teachers from districts serving primarily low-income and minoritized students (Matsumura et al., 2019; Correnti et al., 2020).

In addition to investigating teaching and learning outcomes, a critical aim of our research project is also to explore ways to theorize and study teachers' in situ learning processes and mechanisms of change across contexts (i.e., as they emerge in coaching interactions and corresponding evidence of these changes in practice) (Walsh et al., 2020). In order to build a

coherent theory of teacher change, these efforts include identifying and adapting robust conceptual frameworks that are context-sensitive and provide a means to empirically analyze teacher learning processes and outcomes. To this end, in one recent study we adapted a professional vision framework for novel application in the context of dialogic reading comprehension instruction to explore whether and how teachers' thinking about their classroom choices developed relative to the dialogic discussion goals featured in the coaching. Our analysis of teachers' written and verbal classroom video reflections revealed that over the course of the coaching intervention, teachers became more focused on the connection between their discussion choices and students' thinking opportunities and their reasoning about their videoed discussion interactions became more interpretive and in-depth in nature (Walsh et al., 2020). These findings suggested the potential of a professional vision framework for capturing teacher learning processes and outcomes that are in close conceptual alignment with this professional development context (i.e., the theoretical basis and aims of the coaching and targeted instructional model). This approach also had the advantage of focusing analysis on authentic expressions of teachers' meaning-making processes (i.e., their reflective dialogues) that lends greater empirical robustness and insight than other traditional measures of teacher learning (i.e., paper-and-pencil assessments; self-report surveys, etc.).

Our findings from this initial study thus illuminated a promising path for deeper exploration of a theory of teacher change in this specific context. Two issues in particular were raised that motivated the purpose and design of the present study. The first centers on the fact that although teachers both overall and individually grew the sophistication of their video reflections over the course of the coaching (see Walsh et al., 2020), there was still considerable variation across teachers in the extent to which they grew over time. Secondly, and perhaps most importantly, the scope of the initial study did not allow for any insight into whether and how these changes in

teachers' professional vision linked to specific, corresponding shifts in the nature of their classroom text discussions. Notably, as mentioned previously, we did in other studies find significant overall growth in the quality of teachers' classroom text discussions (Matsumura, 2019; Correnti et al., 2020) but did not include in-depth analyses of how and why teachers varied or explore, on a finer-grain level, the connection between specific teacher learning processes and classroom outcomes.

3.3.2 Research Questions and Design

In the present study, we seek to better understand the relationship between teachers' learning processes in coaching (i.e., 'reflection-on-action') and aligned shifts in teachers' text discussion choices and student learning opportunities in practice (i.e., 'reflection- in-action'). To do this, we employ a comparative case study design to analyze (1) Overall shifts in the quality of case study teachers' classroom text discussion quality over time and (2) Overall shifts in the quality of case study teachers' coaching video reflections over the same time period. Against the backdrop of these overall shifts, we then explore variation in teachers' learning processes and outcomes by analyzing in-depth our focal teachers' learning trajectories as they grappled with a shared pedagogical challenge over the course of the coaching. We specifically ask:

3.3.2.1 RQ (1): What is the Nature and Extent of the Relationship between Shifts in

Teachers' Professional Vision and Text Discussion Quality Over Time?

For the first phase of our inquiry, we analyze overall shifts in teachers' text discussion quality as evidenced in the classroom video data. We will do this by drawing on a coding scheme and analytic approach aimed at capturing evidence (or lack thereof) that teachers' classroom text

discussions became more dialogic over time. In alignment with a professional vision analytic framework, this is specifically organized around measures of: 1. The extent to which teachers create space for student thinking (i.e., the proportion of the discussion characterized by teacher-centered literal questions); 2. The extent to which teachers respond to the *substance* of student thinking and ideas (as evidenced by the proportion of dialogic ‘uptake’ talk moves relative to other types of teacher rejoinders); and 3. The extent to which student thinking is facilitated in discussion (as evidenced by the proportion of the discussion characterized by strong student contributions).

The second phase of our analysis proceeds with an analysis of overall shifts in the quality of teachers’ video coaching reflections. Specifically, using the professional vision framework developed in our first study (see Walsh et al., 2020), we analyze the reflective dialogues of our case study teachers over the same time period, with a specific focus on the nature and extent to which teachers’ noticing and interpretation of their discussion choices in connection to student thinking opportunities (in alignment with the principle underlying goal of coaching intervention) developed over time.

In the final phase of analysis, we explore how changes in the quality of teachers’ reflections relate to changes in teachers’ text discussion quality in the context of a shared pedagogical challenge around opening up space for, and responsively growing, student thinking and ideas in in discussion. We specifically analyze how each teachers’ sensemaking develops in relation to a pattern of practice characterized by the teacher posing a rich open-ended question to initiate student discussion only to constrain their thinking in follow up by posing a series of low-inference literal questions. We also explore the nature of teachers’ efforts (if at all) to address this issue in their subsequent lessons.

Finally, for all phases of analysis, we also draw on a broader set of data that includes the coach's perspective and contemporary notes (i.e., the coach's reflective journal) to explore, on a more nuanced level, key contextual factors (e.g., reflection design features and teacher characteristics) with the potential to offer greater insight into the relationship between reflection and practice. This will especially focus on the specifics of how and why teachers might vary in the extent to which they benefit (or fail to benefit) from participation in professional development with similar design features and aims. Together these analyses will give insight into whether and to what extent teachers' learning processes in coaching (reflection-on-action) through the lens of our professional vision framework links to subsequent changes in the quality of teacher and student talk in discussion (reflection-in-action) and contribute a more complex and nuanced understanding of teacher variation in this context.

3.4 Methods

3.4.1 Participants

The present investigation draws on data collected during the second study year (from January to May 2016) during the remote coaching phase of Online CFC (i.e., following the workshop). For our case study, we specifically focused on selecting teachers from this cohort who completed at least three coaching cycles and had at least four classroom videos (n=5). This enabled us to assess teachers' development over a reasonable span of time, with their cycle 1 video (which was based on a shared 'exemplar' lesson plan and recorded immediately following the workshop) serving as a baseline measure of text discussion quality prior to any engagement in coaching

reflections, and their cycle 4 video (recorded immediately following the third coaching cycle) as a post-invention measure of the impact of three cycles of coaching reflections.

3.4.1.1 Case Study Selection

Several criteria were considered in the selection of our focal teachers, which we have assigned the pseudonyms “Jane” and “Debra”. Our primary selection criteria drew from prior analyses of change in teachers’ text discussion quality over time, with specific aim of selecting teachers: (1) Both showed little to no evidence of strong student discussion at baseline (i.e., cycle 1 classroom video⁶) and (2) Demonstrated substantive but varied levels of improvement in the quality of student discussion over time. We based these criteria on what we surmised would provide the most fruitful context for a comparative case analysis, given our goal of better understanding how teachers’ coaching reflection quality relates to the quality of their text discussion practices. Given that numerous prior studies have consistently shown the effectiveness of Online CFC for improving teaching and learning outcomes on average, we wanted to select teachers that reflected this general trend but also varied enough in their levels of improvement as to have meaningful implications in practice. As will be detailed at the beginning of our findings section, Jane and Debra’s classroom discussion quality outcomes suggest they are well-suited relative to these selection criteria.

⁶ It is important to note that the first classroom video teachers submitted prior to the beginning of the coaching phase (video #1) was based on a lesson plan that all teachers received upon completion of the workshop. The lesson plan, which was based on the short story *Game of Catch* by Wilbur Ross, was pre-populated with stopping points and open-ended questions designed to encourage student discussion and sense-making around salient events in the text.

We additionally drew on selected questions from teachers' post-intervention interviews to ensure no meaningful differences existed between our case study teachers in terms of their expressed enthusiasm for the instructional model and/or their experience in the coaching overall. We specifically reviewed teachers' responses to post-intervention interview questions (conducted shortly after their final coaching cycle) regarding: (1) enthusiasm for the instructional model, including perceived benefits for their students; (2) enthusiasm for the coaching program, including perceived benefits for improving their reading comprehension instruction. Jane and Debra's interview responses indicated ample evidence that both teachers held extremely positive views of the instructional model, the coach, and the effectiveness of the coaching activities, particularly the post-lesson written and verbal video reflection dialogues. That Jane and Debra expressed very similarly glowing reviews of their coaching experiences is important because it suggests that any variation in the quality of learning processes and outcomes, including the extent to which the coaching improved teaching and learning outcomes, was not likely due to differences in teacher 'buy-in' (an often-cited explanation for within-program variation in outcomes in intervention research).

3.4.2 Data Sources and Analyses

Data sources and analyses for this study draw from teachers' first cycle (recorded prior to participation in any online or post-lesson reflective dialogues) and fourth cycle (recorded following their third coaching cycle post-lesson conference) classroom videos (n=2 per teacher, 4). We also drew on teachers' first- and third-cycle written (n= 3 online reflections per cycle per teacher, 12 total) and verbal reflective dialogues (n=1 post-lesson conference transcript per cycle per teacher, 2 total). These analyses are further supplemented with the Online CFC coach's

reflective journal notes recorded immediately following each teachers' post-lesson conference (n= 4 entries per teacher; 8 total) across all four coaching cycles. This serves to triangulate and add further context to our primary analyses of teachers' classroom video quality (reflection-in-action) and coaching reflections (reflection-on-action).

3.4.2.1 Classroom Text Discussion Quality

Analyses for changes in text discussion quality proceeded in several phases. First, we used Studiocode software (Vigital, 1997-2017) to analyze each videotaped discussion using a codebook for individual discourse moves based on an adapted version of the Analyzing Teaching Moves (ATM) framework (Correnti et al., 2015) which was revised to include codes specifically aligned with the Accountable Talk and Questioning the Author instructional models. The whole-group text discussion portion (approx. 45 or 60 mins long) of each classroom video was coded in its entirety, including every teacher question and talk move and student contribution that could be identified in terms of one or all of the student discussion quality dimensions (described below in Table 16). All videos were de-identified, and their order of analysis was randomized so raters were blind to teacher and to video placement within the sequence of teachers' videos. The first author coded all videos collected during year two of the study (n= 35) and a second rater coded a random sample (20%; n=7). Initial exact agreement was 81% and the ICC was 77%. All disagreements were resolved through discussion.

Our codebook captured a wide array of facilitation moves, which varied according to their potential for supporting students to think and reason about text. In the present study, we honed analytic focus on three particular dimensions of text discussion quality aligned with key professional vision skills to create space for, and substantively cultivate, students' thinking in discussion practice. These dimensions, outlined below, include both teacher practice quality

indicators -i.e., teacher talk moves and routines either aligned or misaligned with dialogic discussion features (see Table 13) as well as student discussion quality indicators (see Table 14). The nature of these indicators, as well as the shifts we would expect to see over time given the coaching goals and targeted instructional model, are summarized below.

Table 13 Dialogic Discussion Features and Talk Moves for Eliciting and Growing Student Thinking

Dialogic Discussion Features	Implications for Student Discussion	Interaction Excerpt
<p>Reduced Use of Teacher-Centered Literal Questions <i>Less of the discussion is characterized by literal questions that target easily inferred, discrete, or hyper-specific information that constrain students' thinking opportunities</i></p>	<p>Students have more space in discussion to air their thinking and ideas, giving them greater agency in shaping the course of the discussion and meaning-making processes</p>	<p><i>Teacher: Why did Salva flee his school?</i> Student: There was gunfire.</p> <p><i>Teacher: Who was shooting guns?</i> Student: Soldiers</p>
<p>Increased Use of Student-Centered 'Uptake' Moves <i>More of the discussion is characterized by student-centered questions that substantively engage and pursue student thinking and ideas about text.</i></p>	<p>Students are positioned to centrally engage in rigorous thinking and reasoning processes to construct the gist of text meaning and explore differing interpretations, thus broadening and deepening their critical-analytic reading comprehension skills</p>	<p>See below...</p>
Dialogic Uptake Moves:	Definition of Teacher Move	Interaction Excerpt
<p>Pressing for student reasoning</p>	<p>Teachers ask students to explain their thinking and reasoning to back their assertions</p>	<p>Student: I think Salva is scared for his family. <i>Teacher: What makes you think that?</i> Student: Because Salva had to flee his school and now he can't find his family, so I think he's scared they died.</p>
<p>Raising student ideas for further discussion</p>	<p>Teacher marks or revoices student ideas and brings them forth to the group for further discussion</p>	<p>Teacher: What's going on here? Student: [Salva's] being friendly to a stranger that's in the Dinka tribe. <i>Teacher: Ok, Shana pointed out the woman Salva encountered is from the Dinka tribe. Can someone explain why that's significant? Emma?</i></p>
<p>Inviting students to link ideas</p>	<p>Teacher invites students to build off of or challenge ideas put forth by their peers</p>	<p>Student: I think home is one of Salva's [most] significant losses. <i>Teacher: Okay, Amber thinks "home" is one of Salva's most significant losses. Paula, I see you're nodding, do you have something to add to that?</i></p>
<p>Synthesizing student ideas</p>	<p>Teacher explicitly links one or more student ideas to build coherence</p>	<p>Student: I don't think Salva was upset by [the woman] leaving because she made him do a bunch of work and then abandoned him. <i>Teacher: So Mark said [the woman] wasn't a significant loss because she made him do work and then she left him.</i></p>

		<i>But Shannon thinks that she was a significant loss [to Salva] because staying with her kind of made him feel like he had a home again.</i>
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3.4.2.2 Proportion of teacher-centered ‘literal’ questions relative to other discussion moves.

As shown in Table 13, the first discussion quality indicator is the extent to which teacher-centered ‘literal’ questions characterize the overall amount of teacher and student talk in discussion. We specifically examined whether and to what extent the overall proportion of talk characterized by teachers’ use of low-level literal questions in text discussions shifted over time (see Table 16). When teachers rely on low-inference literal questions to develop and steer the trajectory of classroom discussion, students’ opportunities to grapple with larger text ideas and themes are attenuated. The proportion of literal questions relative to other, more productive kinds of teacher and student talk, thus provides one indicator of whether and how teachers are cognizant of the space they are providing for students to air their thinking and ideas in discussion. As such, we would expect that any observed developments in teachers’ professional vision would correspond with a decrease in the proportion of literal questions in classroom discussions over the course of the coaching.

3.4.2.3 Proportion of dialogic teacher ‘uptake’ moves relative to other rejoinders.

As outlined in Table 13, the second discussion quality indicator relates to the nature of teachers’ ‘rejoinder’ moves, with a focus on the extent to which teachers treated student contributions as legitimate “objects of inquiry” in discussion (Sherin & van Es, 2009, p. 25). Specifically, we calculated the proportion of dialogic teacher ‘uptake’ moves that respond to the substance of student ideas relative to other kinds of teacher rejoinders that do not directly respond

to or invite deeper student thinking and reasoning about text. Dialogic ‘uptake’ moves in this context include: Pressing for student reasoning, raising student ideas for further discussion, inviting students to build off one another’s ideas, and synthesizing across student contributions to build coherence (see Table 14). Other types of (‘non-uptake’) rejoinders that were coded and analyzed include: Repeating student contributions, collecting student contributions, and following up a student contribution with a literal question. These kinds of teacher responses were categorized as ‘non-uptake’ because they do not build off of, extend, and substantively engage students’ critical thinking and about the ideas put forth by themselves and their peers. As such, we would expect a decline in teachers’ of these less substantive types of rejoinders relative to focal dialogic ‘uptake’ moves in their text discussion facilitation over time.

Importantly, as with all new instructional moves and features, it is possible that teachers can ‘tack on’ dialogic uptake talk moves without actually deploying them in ways that actually grow student thinking or shift their talk routines significantly (i.e., ‘proforma’ adoption). Our final indicator that captures change in the quality of students’ discussion contributions (described below) is therefore critical for differentiating between superficial and meaningful shifts in teachers’ use of ‘uptake’ talk moves to skillfully respond and grow students’ thinking in discussion (see Table 14).

Table 14 Definitions and Examples of Strong Student Discussion Indicators

Student Discussion Quality Dimension	Definition	Example
Strong evidence	Student offers accurate and specific text evidence to back their claim	<i>Student: It says on the top of p. 18 that Salva “worked hard so [the woman] would not send him away.” So Salva didn’t know that she was gonna leave him in the end.</i>
Strong explanation	Student offers elaborated reasons/justifications in support of their claim	[In response to the teacher’s question: “Why do you think Salva was working as hard as he could to stay in the barn?” <i>Student: Because the old lady was the only person around that Salva knew...they were the only ones in that part of the village. So if Salva didn’t work then he would have been sent away and he would’ve been all alone again.</i>
Strong link	Student makes contribution that substantively connect to other student ideas and lines of inquiry	<i>Student A: I think Salva’s angry that he’s being forced to work for this woman.</i> <i>Student B: I disagree because in the text it says that the woman gave Salva food and shelter for his help, she didn’t force him...</i>

3.4.2.4 Proportion of strong student discussion contributions relative to overall talk in discussion.

Student discussion quality was analyzed using codes that captured three indicators of strong discussion: Strong use of evidence, explanation in support of claim (s), and linking to other ideas and contributions put forth by their peers (see Table 14). We specifically calculated the proportion of these discussion quality indicators relative to all other talk in the discussion by these in order to examine whether, and to what extent, strong student contributions were substantively present in teachers’ classroom text discussions and if this shifted over time. As mentioned, the quality of students’ contributions is arguably the strongest indicator of dialogic discussion quality, as it gives the clearest signal of whether teachers are employing talk moves in ways that actually increase the rigor of students’ thinking and discussion around text (see Matsumura et al., 2019; Correnti et al., 2020). We would therefore expect classroom discussions to become increasingly

characterized by strong student contributions as teachers become more adept at noticing and interpreting their discussion choices in connection to student thinking in their video reflections.

3.4.2.5 Teacher Reflection Quality

To assess changes in the quality of teachers' reflections over the course of three coaching cycles, we applied a combination of descriptive and provisional coding procedures and used NVivo 10 (QSR International, 2012) to analyze the online written reflections and the post-lesson conference coaching transcripts, using a professional vision framework (Sherin & van Es, 2009) as a guide. We began by dividing each transcript into two parts: teachers' comments related to their classroom practice and the coach's facilitation "moves." Teachers' comments were further divided into "idea units" (Jacobs & Morita, 2002), or segments in which the teacher discussed a particular event or idea related to classroom instruction. We then assigned codes to capture each dimension of professional vision: selective attention (i.e., 'topic') and knowledge-based reasoning (i.e., 'stance').

3.4.2.6 Shifts in teachers' selective attention.

To assess shifts in teachers' selective attention over the course of the coaching, we coded each idea unit according to the "topic" of that particular reflection. Here, we categorized the data using coding schemes from Sherin & van Es (2009) and Tekkumuru-Kisa & Stein (2014), and added any topics that were specific to our data. Our analyses yielded primary topic categories related to pedagogy, student thinking, and general student discussion or participation (see Table 13 for codes and definitions). Following Tekkumuru-Kisa and Stein (2014), 'pedagogy' codes were further analyzed to capture the extent to which they referenced students (see Table 15).

Table 15 Selective Attention (Topic) Codes

'Topic' Codes	Definition	Example
Student Thinking	How students are making sense of text content; what they appear to think or understand	“But she’s also relating to Salva, the fact that he’s been left behind time and again...she goes on to talk about the cold fist grabbing his heart. I can think of at least five of my students whose mothers have left them...so I think they really connect to that theme of the feeling of loss in Salva’s story.
Pedagogy		
<i>Not linked to students</i>	Teacher’s actions (or possible actions) with no explicit link to students	“The third video...I think I rushed through it because I realized when I was kind of like 30 or 40 minutes or something...I needed to kind of speed it up so I just reworded the question in a way that I thought it was an open-ended question but I don't know what you think about that...”
<i>Linked to students at a general level</i>	Teacher’s actions (or possible actions) linked to students’ discussion participation at a general level	“It kind of started with an open-ended question. So with that first teacher move, they have to respond in longer, more elaborate ways. So we hadn't read the text yet, but it gave them a hook and an interest into why they're gonna read that portion.”
<i>Linked to specific student thinking and ideas</i>	Teacher’s actions (or possible actions) specifically linked to student thinking and/or contribution	“So that goes along with what [the previous student] was saying, that he might feel safe to see someone from his own tribe. I didn’t want to steer too far from the initial question...but now as I’m reflecting, I’m thinking maybe we should have gone back in the text and recapped and reread about the government and the rebels, and then maybe ask [the students], ‘who are these rebels?’ That may be something I would have to further explain, because they're looking at it as four separate groups...the government, the rebels, and the two tribes. I think they're confused by who the rebels are and exactly who the author is talking about.”

General Student Discussion or Participation	How students are generally engaged in discussion of text or other classroom participation dynamics (e.g., enthusiasm for text, whether students are paying attention, other material or logistical factors affecting discussion).	“They construct that meaning, yes absolutely. I think with this group of kids that I have this year, they do a great job of that, of sharing their ideas... So, they’re speaking their thoughts and then one person says, “Oh, I thought,” and then they kind of piggyback off one another.” “The lesson as a whole definitely went on too long, much longer than I thought...and one of my students who doesn’t [normally] misbehave was misbehaving. I’m not sure either about how they’re sitting. I wonder if they should’ve been at their seats.”
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3.4.2.7 Shifts in teachers’ knowledge-based reasoning.

To examine teachers’ knowledge-based reasoning or “stance”, we coded each idea unit in terms of how the teacher approached making sense of an event or idea under discussion (Sherin & van Es, 2009). Each idea unit was coded as representing one of three types of stance:

- 1.) Evaluative, or analyzing for the sake of judgment or criticism;
- 2.) Descriptive, or providing a literal description of a classroom scenario or
- 3.) Interpretive, which involved making inferences about why events occurred as they did. For each idea unit assigned an “interpretive” main code, we also applied a sub-code to describe the depth and specificity of these interpretations, allowing us to capture finer-grain changes in the quality of teachers’ reasoning about their classroom interactions. We conceptualize this in two stages:
 - 1.) Surface-level: Teacher provides little or no specific evidence and elaboration in support of their inferences and
 - 2.) In-depth: Teacher provides specific evidence and gives elaborated reasons in support of their inferences (see Table 16).

Table 16 Knowledge-based Reasoning (i.e., Stance) Codes

‘Stance’ Codes	Definition	Example
Evaluative	Offering appraisals related to the success or failure of a pedagogical interaction absent any reasoning to inquire about potential causes and effects	“They came alive, because there’s some days that the discussion is better than others...It really was one of their better discussions.”
Descriptive	Giving literal descriptions about events captured in video	“I stopped and addressed her misconception and like I said I pressed for accuracy and we found it with the help of other children plus herself and we were able to correct her mistake and then move on”
Interpretive		
<i>Surface level</i>	Engaging in pedagogical reasoning to inquire about potential cause-effect links <i>without</i> reference to specific video evidence and elaborated reasons in support of interpretations (i.e., gives a “what” but no “why”)	“I think [the students] were really struggling to grasp the big ideas in this chapter. Like, one of my main points to get across was simply the idea that water is important for survival and I don’t think that really came across in their discussion.”
<i>In Depth level</i>	Engaging in pedagogical reasoning to inquiry about potential cause-effect links <i>with</i> reference to specific video evidence and elaborated reasons in support of interpretations (i.e., gives a “why” in addition to the “what”)	“When I pressed for accuracy, I noticed students found specific details in the text to support their responses. Like when I asked how they could tell the boys would be friends, students pointed out several examples within the text having to do with commonalities, actions, and feelings. Also when I pressed for reasoning asking, ‘What does that mean all the way to his heart,’ they were able to defend and explain their claims as one student explained it meant that they had the same feelings.”

Finally, we calculated the number and percentage of teacher reflections that related to each category for each online written reflection and post-lesson conference. This allowed us to assess shifts in teachers’ professional vision over the course of the coaching.

3.4.2.8 Coach reflective journal entries.

Finally, we analyzed entries from the coach’s post-lesson reflective journal as a way to supplement and contextualize our primary data sources and analyses (n=4 entries per teacher; 8

total). Serving as an informal means for documenting and tracking teachers' progress over the course of the coaching, these journal entries did not follow a rigid structure or protocol and included the coach's thoughts and reactions to teachers' videoed text discussions, online written comments, and post-lesson reflections, in addition to her inferences about teachers' learning trajectories and progress. We obtained these journal entries from the coach engaged in iterative rounds of descriptive and thematic coding to identify recurring topics (first-level descriptive coding) and subsequent categories abstracted from analysis of key similarities and differences (second-level thematic coding) (Miles & Huberman, 1994). We focused attention in particular on coach comments that evidenced her perception of: (1) The nature of teachers' reflections in the online coaching system and in the pre-and post-conferences over time; and (2) Teachers' progress in implementing the instructional model in their classrooms. From this process we elicited key themes to characterize the coach's perception of each teachers' learning trajectory in connection to these two dimensions. Follow-up questions and discussions with the coach occurred throughout each round of coaching to, when needed, clarify the meaning of her notes and substantiate our inferred themes and interpretations.

3.5 Findings

Our case study analyses suggest a link between the quality of teachers' video reflections (i.e., professional vision) in coaching and the rate and extent to which they improved the quality of their text discussion practice over time. These analyses also revealed, however, additional layers of complexity that suggest this relationship is not straight-forward, but highly nuanced and influenced by a variety of individual- and context-level factors. The following sections illustrate and unpack these phenomena,

beginning with an exploration of how Jane and Debra’s instructional quality and change trajectories converged and diverged in key ways.

3.5.1 Converging Patterns of Instructional Change: Shifting from ‘More Teacher-Centered’ to ‘More Dialogic’ Text Discussion Practices

Our findings indicate that overall, both Jane and Debra became more adept at making space for student ideas and facilitating student thinking in their text discussions over the course of the coaching. As illustrated in Table 17, these shifts are evidenced by a decreased proportion of literal questions in tandem with an increased proportion of dialogic ‘uptake’ moves (e.g., pressing for student reasoning, inviting students to link ideas) relative to other kinds of rejoinders (e.g., repeating and collecting but not exploring students’ ideas) in both teachers’ text discussions from cycles 1-4. Most importantly, our findings also suggest that these shifts in Jane and Debra’s text discussion practices corresponded with parallel improvements in student thinking opportunities in text discussion, as evidenced by the substantively increased proportion of strong student contributions in both teachers’ classroom videos over time (see Table 17).

Table 17 Shifts in Jane and Debra’s Text Discussion Quality Over Time (Cycle 1-Cycle 4)

Text Discussion Quality Dimension	Coaching Cycle				% Difference Cycle 1-4	
	Cycle 1		Cycle 4		Jane	Debra
	Jane	Debra	Jane	Debra		
<i>% Literal Questions</i>	18%	30%	3%	6%	-15%	-24%
<i>% Uptake/Rejoinder</i>	27%	17%	43%	24%	+16%	+7%
<i>% Strong Student Contributions</i>	1%	2%	21%	12%	+20%	+10%

One noteworthy finding highlighted in Table 17 is the relatively strong, simultaneous presence of both teacher-centered literal questions and student-centered uptake rejoinders in Jane and Debra's baseline (cycle 1) videos. This finding suggests that teachers' initial text discussions were characterized by a kind of 'hybrid' of traditional and dialogic text discussion practices. Importantly, as is indicated by the almost complete absence of strong student discussion in their cycle 1 videos (see Table 17), the nature of both teachers' baseline text discussions appears to have nonetheless been firmly teacher-centered in practice.

One potential explanation for this pattern may relate to how Online CFC was designed to support teachers' transition from the workshop to the coaching phase. Specifically, at the end of the workshop teachers received a model lesson plan that they studied and discussed with their colleagues (prior to coaching) and the coach (during their first pre-lesson conference) prior to facilitating and recording their first text discussion. This model lesson provided a significant scaffold for teachers' initial efforts in that it specified expert-informed suggestions for stopping points, open-ended questions, and facilitation moves for each discussion segment. In this way the model lesson plan served as a kind of 'boundary object' (Star & Griesemer, 1989) or tool to concretize and extend what teachers had learned in the workshop in their own text discussion practice. Having these specific suggestions for talk move phrasings and use readily available during their initial text discussions likely eased the path for Jane and Debra to try out new discussion practices from the very start of coaching.

While this guidance likely contributed to the substantive presence of uptake talk moves in their baseline videos, however, the student discussion quality findings outlined above suggest that neither teacher had yet learned to use them strategically to achieve dialogic discussion goals and principles in practice. Moreover, the effectiveness of these uptake moves would have been

undercut by the multitude of unplanned literal questions that both teachers appeared to spontaneously ‘add in’ during instruction (i.e., deviating from the model lesson plan). To this point, a significant amount of teachers’ activity (both in the workshop and in the pre-lesson conference with the coach) prior to their initial lessons included focused discussion around the ways in which low-inference, literal questions can undermine the availability and rigor of students’ thinking opportunities in text discussion. Thus, the substantial role of literal questions in teachers’ baseline text discussions despite these supports testifies to the deep entrenchment of teacher-centered discussion patterns in classroom practice.

One interpretation of the results in Table 17 is that as a result of their participation in the interim coaching cycles (i.e., from cycle 1 post-lesson reflection to cycle 3 post-lesson reflection), both teachers grew their ability to create space for student thinking (i.e., ‘weed out’ literal questions) and respond to and grow the substance of student thinking (i.e., deploy uptake moves in intentional strategic ways) in their text discussions. These results also suggest, however, some marked differences in the nature and extent of Jane and Debra’s text discussion quality and levels of change over time. In the following section, we briefly discuss some of these key divergences before turning to our analyses exploring variation in the quality of their reflective coaching dialogues.

3.5.2 Diverging Patterns of Instructional Change: Rapid vs. Incremental Growth

As illustrated in Table 17, Jane demonstrated striking improvements across all instructional quality dimensions over the course of the coaching. These findings specifically suggest that, by her final text discussion, Jane had weeded out literal questions almost entirely from her practice (to just 3% of total teacher talk moves), increased her use of dialogic uptake moves relative to

other rejoinders (to over 40%), and increased in the proportion of strong student contributions in discussion (to 20%). Interestingly, although Table 17 suggests Jane had some baseline advantages compared to Debra in terms of teaching practice quality (i.e., the first 2 rows of Table 17), Jane's levels of growth and final scores suggest these disparities widened over the course of the coaching. Jane's cycle 1 to cycle 4 growth in the proportion of dialogic uptake moves in text discussion, for example, was substantially greater compared to Debra (16% compared to 7%), essentially doubling the initial quality disparity between the two teachers at baseline (10% gap in cycle 1 vs. 19% gap in cycle 4). Most poignantly, Jane's final classroom discussion demonstrated almost twice the proportion of strong student contributions compared to Debra's final discussion (21% compared to 12%) despite their virtual absence in both teachers' discussions at the start of coaching.

As can be seen in Table 17, Debra's improvements were markedly more attenuated than Jane's. One notable exception is the striking decrease in the proportion of literal questions in Debra's text discussions over time (from 30% to 6%). Debra's apparently strong tendency to 'fill in' (or revert to) literal questions at the start of coaching⁷ indicate that teacher-centered norms and practices (i.e., high levels of teacher talk and influence in the discussion) might have been especially strongly entrenched in Debra's teaching. If so, countering the habitual 'pull' of literal questioning routines may have been an especially formidable challenge for Debra. Together with the similarly positive trends in the proportion of uptake moves relative to other rejoinders (17% to 24%) and strong student contributions (2% to 12%), these results perhaps suggest that Debra's dramatically reduced use of literal questions allowed more space for student ideas to proliferate in

⁷ Again, because teachers used an exemplar lesson plan in cycle 1, literal questions in these were largely unplanned

her final text discussion- which would in turn create more opportunities for Debra to effectively notice and respond students' thinking. However, the burden of 'unlearning' I-R-E questioning practices- particularly in Debra's case where they appeared to be so integral to her practice prior to coaching- perhaps created a barrier to her progress in shifting her instruction to be truly 'student-centered' in nature.

In summary, these results suggest that both case study teachers made substantive gains in the quality of their classroom text discussions. It is striking, however, how much more Jane improved relative to Debra, particularly with respect to effectively leveraging dialogic talk moves to elicit and build students' thinking in her text discussion practice. In this sense, Jane can be viewed as an exemplar 'success story' of the coaching, as she achieved these remarkable shifts within a relatively short period of time. In the following section, we further explore the interpretations raised here by examining Jane and Debra's reflective coaching dialogues over the same time period. We specifically focus on investigating dimensions of each teachers' coaching interactions could shed light on the instructional quality and growth variation discussed above. To do this, we draw on findings from our analyses of Jane and Debra's professional vision trajectories as well as the coach's reflective journal entries to add further context and triangulate our independent analyses.

3.5.3 Teachers' Professional Vision: The Role of a Critical Inquiry 'Lens' for Noticing and Interpreting Teaching Moves and Student Thinking in Discussion

Similar to our instructional quality findings, our analyses of Jane and Debra's reflective dialogues suggest both teachers generally improved their video reflection quality over the same time period. As shown in Table 18 (below), our findings specifically indicate overall growth in

teachers' professional vision from cycle 1 post-lesson reflection (conducted immediately after initial (baseline) text discussions) to cycle 3 post-lesson reflection (conducted immediately prior to final (cycle 4) text discussions). We highlight in particular both teachers' improvements on selected professional vision dimensions (highlighted in bold text in the last column of Table 18) that we consider most relevant for our theory of teacher change in this context. In terms of selective attention, these include: (1) Decreased focus on teacher actions absent any reference to student learning; and (2) Increased focus on teacher actions in reference to specific student ideas and thinking quality (see rows 1 and 3 in Table 18). For knowledge-based reasoning or 'stance,' these include: (1) Decreased tendency to engage in either evaluative or surface-level interpretive reasoning; and (2) Increased tendency to engage in in-depth interpretive reasoning (see last three rows of Table 18).

Notably, also in parallel with our instructional quality findings, results in Table 18 indicate substantial variation between Jane and Debra in the nature and extent of their professional vision quality and growth over time. Specifically, Jane, relative to Debra, demonstrated a markedly greater tendency to notice, and engage in in-depth reasoning about, the influence of her discussion moves in connection to students' thinking, particularly towards the end of the coaching. As we discuss below, one especially notable pattern emerged in the distinct ways in which Jane and Debra responded to the coach's prompts to think critically and question their assumptions about how and why their pedagogical choices may have negatively impacted students' thinking opportunities. These findings, as well as the coach's observations in connection to these qualities of Jane and Debra's reflections, are detailed for each teacher below.

3.5.3.1 Jane

As illustrated in Table 18, our findings suggest Jane started the coaching with a relatively strong focus on the connection between her teaching moves and students' thinking in text discussion, the most advanced selective attention 'indicator' in our professional vision framework. Moreover, our results indicate that the quality of Jane's selective attention grew rapidly as the coaching progressed over time. As shown in Table 18, almost half of Jane's pedagogy-related reflective comments in cycle 1 (45%) referenced student thinking, but by her third coaching cycle, these comprised the substantial majority (80%) of her pedagogy-related reflections. In addition, none of Jane's cycle 3 reflections focused on her teaching moves irrespective of how they impacted students, representing an 18% decrease from cycle 1.

Perhaps the most striking aspect of Jane's trajectory relates to the quality of her knowledge-based reasoning- particularly with regard to growth in the quality of her interpretive comments over time. As shown in Table 18, relatively few (18%) of Jane's cycle 1 interpretive comments evidenced in-depth reasoning about students' thinking in discussion. By contrast, her cycle 3 results indicate a 44% increase in the proportion of such comments, meaning that the majority of her interpretive comments in cycle 3 (62%) evidenced this highly advanced level of reasoning. In addition, very few (7%) of her cycle 3 reflections were evaluative in nature, down almost 20% from cycle 1.

Taken together, these results suggest an extraordinary qualitative shift in Jane's professional vision over a relatively short time period. These improvements are marked by a strong focus on how her talk moves impacted student thinking in text discussion, and a sophisticated use of evidence and explanation to analyze and interpret her videoed classroom interactions, as illustrated in the following excerpt drawn from Jane's cycle 3 written reflections:

I think that by choosing this particular stopping point and using an open-ended question gave the students a lot to talk about... it really allowed them to untangle the text and what was happening in the story through their discussion. Because they had read enough about Nya's journey, they were able to understand and really unpack the severity of the water situation.

Table 18 Shifts in Jane and Debra’s Professional Vision in Coaching Reflections from Cycles 1-3

Professional Vision Dimension	Coaching Cycle				% Difference Cycle 1-3	
	Cycle 1		Cycle 3			
	Jane	Debra	Jane	Debra	Jane	Debra
<i>Selective Attention</i>						
Pedagogy*						
-Not linked to Students	18%	17%	0%	9%	-18%	-8%
<i>-Linked to Students at a General Level</i>	37%	50%	20%	57%	-17%	+7%
-Linked to Specific Student Thinking and Ideas	45%	25%	80%	36%	+35%	+11%
Student Thinking	6%	0%	14%	11%	+8%	+11%
General Student Discussion or Participation	24%	33%	7%	6%	-17%	-27%
<i>Knowledge-based Reasoning</i>						
Evaluative	29%	56%	7%	38%	-22%	-18%
Interpretive*						
-Surface level	82%	100%	38%	85%	-44%	-15%
-In Depth level	18%	0%	62%	15%	+44%	+15%

* Pedagogy subcode percentages are relative to total number of Pedagogy codes

** Interpretive subcode percentages are relative to total number of Interpretive codes

In this excerpt, Jane reflects on the relationship between her discussion choices, student thinking, and text content- signaling a sophisticated professional vision aligned with dialogic discussion goals and principles.

Aligned with these observed shifts in professional vision, the coach consistently noted that Jane was “extremely reflective” both in her online written reflections in CASTL prior to their post-lesson conferences and during the post-lesson conferences themselves. Throughout her coaching cycles, Jane critically interrogated the impact of her instructional decisions on student’s thinking opportunities and was thinking generatively about alternative pedagogical moves, often with minimal assistance or prompting from the coach. For example, when asked by the coach during

her first cycle to think through how she might respond in a future situation where students needed assistance working through potentially confusing or complex text events. Jane responded:

I certainly spend more time dispelling misconceptions than I do discussing the appropriate connections. One part of my thinking may be that the students who are providing the "correct" connections are students that I do not worry about understanding or comprehending the text. Perhaps my thinking is that working with students who need more clarification...is the better use of discussion time? If I found myself in a similar situation, I might have the students turn and talk after the connection was made...discussing among themselves with a partner what Jayda had presented and how it tied in with their own thinking, I might also press for reasoning with the students who were confused. If they could not provide evidence, would they think differently about their answers?

In this excerpt, Jane reflected critically on her own thinking in the moment and used this as a basis to generate ideas for alternative actions. These kinds of responses suggest a stance towards reflection as a tool for learning and professional growth. From the coach's perspective, these qualities of Jane's participation in the reflective process positioned her to reap optimal learning benefits from the coaching activities: "[Jane's] consistently reflective stance has helped her grow and sustain her practice...she is one teacher who has firmly embedded the [instructional model] processes into her teaching."

3.5.3.2 Debra

Mirroring the somewhat more attenuated improvements we observed in her instructional quality, our analyses of Debra's coaching dialogues suggest a correspondingly more modest level of growth in her professional vision over time. Specifically, in terms of selective attention, results

suggest that compared to Jane, Debra was considerably less focused on the cause-effect links between her teaching moves and students' thinking opportunities in discussion, both at the start of coaching and over time (see Table 18). As shown in Table 18, Debra's most notable improvement appears to have come in the form of a sharp decrease in focus on students' discussion participation more generally (e.g., non-specific observations about students' levels of enthusiasm or engagement in discussion) from 33% in cycle 1 to just 6% in cycle 3. This improvement corresponded with similarly positive trends in her attention to student thinking (11% increase from cycles 1 to 3) and the influence of her teaching moves on students' thinking (11% increase from cycles 1 to 3).

Perhaps most noteworthy in terms of Debra's learning, however, are the shifts we observed in the quality of her knowledge-based reasoning. We specifically call attention to results indicating a decreased proportion of evaluative comments (-18% from cycles 1 to 3), and an increased proportion of interpretive comments evidencing in-depth reasoning and explanation (+15% from cycles 1 to 3). This latter result is particularly significant in light of the fact that Debra's interpretive comments were entirely surface-level at the start of the coaching, signaling an important advance in her learning.

However, though positive in nature, Debra's results become more tempered when viewed in comparison to Jane's. For example, though Debra became more focused on students in her pedagogy-related comments over time, the majority of these (57%) remained at the level of general student discussion participation (rather than the content of their thinking, see row 3 in Table 18). Similarly, evaluative comments still comprised a substantive proportion (38%) of Debra's cycle 3 reflections despite her progress on this measure, indicating she remained markedly more evaluative in her reasoning relative to Jane, both at the start of coaching and over time. Moreover, though the

proportion of Debra's in-depth interpretive comments increased, the substantial majority of her interpretive comments (85%) remained at surface-level by the end of coaching. Taken together, these results suggest that, in line with the instructional quality results, Jane began the coaching with somewhat of an advantage in terms of the quality of her noticing and reasoning in reflection. Over time, this disparity widened considerably as Jane appeared to reap optimal learning benefits from her coaching cycles.

Significantly, after her first coaching cycle with Debra, the coach remarked that although Debra consistently presented as a very enthusiastic teacher strongly committed to participating in the coaching process, she also perceived her to be extraordinarily resistant to engaging in critical reflection. As the coach wrote in her journal: "[Debra] often focuses on justifying her actions and struggles rather than actually reflecting on her instructional decisions and the impact they had on the text discussion and student learning." These observations echo aspects of our findings outlined in Table 18, most notably those suggesting a relatively strong disposition to be evaluative in reflection. In a reflective prompt for one of Debra's cycle 1 video clips, for example, the coach had asked her to consider the kinds of responses she aimed to elicit from students and generate ideas for how talk moves associated with Accountability to Rigorous Thinking may have been used to elicit and grow more robust student thinking in a complicated portion of text. In response, Debra wrote:

Some moves that support accountability for rigorous thinking would be to use challenging questions, press for reasoning, expanding reasoning, modeling and recapping. I felt that these strategies were addressed when I asked some follow up questions: Challenging questions: "What does Monk seem like?"; pressing for reasoning: "seems like Glennie...?" expanding reasoning: "What just happened?"; Recapping: " who said this?"

Rather than engaging in the reflective process prompted by the coach, Debra instead defined the list of possible talk moves located in the Accountability to Rigorous Thinking framework dimension and sought to justify her initial actions by attempting to map them onto this list of moves. Moreover, although she included quotes from the video clip, they were non-specific and unelaborated in terms of the particular interactions she was referencing in support of her assertions. It is interesting to consider the contrast between this excerpt and the one detailing Jane's responses to a similar prompt at the same stage of the coaching (cycle 1, see excerpt immediately following Table 18 above).

Notably, although not completely abated by her third coaching cycle- where the coach noted that Debra still struggled to "critically reflect" on her teaching and "notice contradictions in what she plans and then executes,"- there is evidence to suggest that Debra did make progress both in her willingness to critically analyze her teaching and in the quality of these interpretations. This shift is reflected both in our findings related to Debra's growth in knowledge-based reasoning outlined in Table 18, as well as in the coach's observations, as expressed in her journal entry following Debra's cycle 4 post-lesson conference:

[Debra] is more focused on her teaching moves and their link to student learning- she was quicker to think about what she could have done differently and how that might have better assisted her students at those points in the text discussion. This represents a significant gain for this teacher.

To summarize, analyses of Jane and Debra's instructional and reflective practice trajectories suggest a close link between teachers' professional vision and dialogic teaching practice. Specifically, differences in how each teacher engaged in reflection, particularly with respect to questioning prior assumptions about how and why particular teaching choices may not have met goals for student thinking in discussion, appear to be linked to rate of growth in dialogic

discussion quality. In short, Jane was quick to critically analyze her videoed discussion interactions from the start of coaching, whereas Debra tended to engage in much less critical analysis about the effectiveness of her pedagogical choices. This approach may have in turn put Jane at an advantage to reap optimal benefits from the coaching reflections, as evidenced in the extraordinary growth she exhibited in her professional vision in reflection and her text discussion quality in practice. In our final set of analyses and findings described below, we further investigate these issues by exploring in-depth each teachers' development in the context of a shared pedagogical challenge.

3.5.4 The Role of Tacit Assumptions for Either Changing or Reinforcing Existing Classroom Discussion Practices

3.5.4.1 Jane

Our analyses of Jane's reflections and classroom videos suggest a close connection between the content and quality of Jane's reflections during her coaching cycles and specific changes in the quality of her classroom discussions. In the early stages of the coaching, Jane showed a tendency to pose a series of close-ended literal questions to her students often after she had already asked a well-constructed open-ended question about a portion of the text. During her first coaching cycle, it came to light that Jane viewed close-ended literal questions as a means for granting her struggling readers access to the discussion. One of the coach's goals for reflection more generally on this issue is for teachers to understand how this pattern of questioning essentially reserves the richest thinking opportunities for the 'high-level' readers and discussion participants, while the struggling or quieter students are relegated to answering mostly low-inference follow-

up or closed questions. The following Excerpt (Table 19) from Jane’s first classroom text discussion Jane’s first classroom video, illustrates this pattern of interaction:

Table 19 Classroom Discussion Excerpt from Jane’s First Coaching Cycle Video

<i>Turn</i>	<i>Speaker</i>	
1	Jane:	So what’s going on now?
2	Student A:	He said to throw him some grounders.
3	Jane:	Who said the word “grounder”?
4	Student A:	Scho..
5	Jane:	So I think you are looking at this line here, where Scho says “you can throw me some grounders but don’t ‘burn ‘em.” So you think Scho is saying what to them?
6	Student B:	Scho was asking the person to give him some tips...give him some grounders...
7	Jane:	Do you think a grounder is a tip? Who’s played baseball? What’s a grounder?
8	Student C:	When you roll the ball.
9	Jane:	When you roll the ball along the ground. So maybe that will help us out. So what else do we think is going on? Ariana?
10	Student D:	Scho doesn’t want them to roll the ball too hard
11	Jane:	Don’t roll the ball too hard, too fast. The two boys were playing pretty well right? Then Scho comes along and says don’t throw the ball too hard or too fast. Don’t burn it. He doesn’t have catching... ?
12	Student E:	Skills?
13	Jane:	Skills?
14	Student F:	Experiences?
15	Jane:	Experiences?
16	Student G:	A glove?
17	Jane:	A glove...he doesn’t have a glove, we said that earlier...remember that? Good, Mike, good catch. So how does Scho fit in here? How does he fit in with these other boys, Monk and Glenny?
18	Student H:	They have to slow down to make sure [Scho] can catch
19	Jane:	They are gonna have to change what they are doing, slow down to make sure Scho can catch is what you’re saying?
20	Student H:	(nods silently)
21	Jane:	So does he fit in with the other boys?
22	Students:	“No” [choral answer]
23	Jane:	No he does not.

Jane began this exchange by posing an open-ended question (T1: “So what’s going on now?”) but ended by asking a series of lower-level questions, including a fill-in-the-blank question (T11: “He doesn’t have catching... ___?”) and an unplanned closed-ended question (T21: “So does he fit in with the other boys?”). In her reflective prompt in CASTL, the coach had asked Jane to consider the balance of teacher-student talk in this exchange and think about how talk moves

could have been used to assist students to do more of the “cognitive lift.” In her response, Jane observed:

I thought for sure that I asked each question the way I wrote it down in my [lesson plan], but when I went back and looked, the question "How do you think Scho fits in here?" became "Does he fit in with the other boys?" during the lesson. I do think that it may be because [the students] were struggling a little and I wanted to make sure my lower students were able to access the information and the gist of that section just as easily as the higher students. I started with an open question, but apparently thought that some students needed clarification of what that question meant.... I have had so much experience with students who need a significant amount of pre-setting, that I don't wonder now if it has become more of a hindrance to them and their thinking rather than a help.

Here, Jane made inferences about how her thinking in the moment of instruction may have influenced her instructional decisions, and how these in turn may have resulted in differential consequences for students’ thinking opportunities. Interestingly, Jane came to the realization that some of her teaching decisions were being guided by this belief without any explicit prompting by the coach. In her post-lesson conference, Jane built on these initial observations and concluded that her tendency to ask closed questions, particularly for lower-level readers, was a habit that she needs to be more mindful about, acknowledging that she needs to adapt her teaching to engage these students in more rigorous discussion. She concludes these thoughts by coming up with some alternative strategies to support her struggling students to engage in richer discussion opportunities:

Table 20 Reflection Excerpt from Jane’s First Post-Lesson Coaching Conference

Coach:	So, interestingly enough, before you asked [“Does Scho fit in with the other boys?”], you asked: “How does Scho fit in here?” A student says they have to slow down to make sure he's able to catch. You get a longer answer. But then you ask does he fit in with the other boys? And you get no [laughs].
Jane:	Yeah. I wonder if that was a result of, like, some of the kids getting it and I see that half of those kids got the question and they got the other student's answers...And then right in front of me is a group of, I guess, my lower – they really struggle with processing type things. And I wonder if at that moment when I was looking at them, I still saw the blank looks on their faces. They weren't getting it. So I just followed up with a question that I thought would make that more accessible for them..
Coach:	Uh-huh. So you've been talking a lot about making sure that whe some students get it the other students can access that, which is a big part of text discussion –
Jane:	The other part of the problem, and this is maybe – again, it's a problem with me. It's that two or three kids that no matter what question I ask- they get it. So when I ask an open-ended question like that, those kids immediately have an answer. And I think I don't always want to call on them all the time, because then nobody else does any thinking, 'cause these kids are doing it for them. So building in some wait time will kind of allow everybody to have that or have that turn and talk. So if I ask a question and I'm getting the majority of blank faces except for these three or four kids...that turn and talk, discuss it with a partner, what do you think is going on, and building in some more of those talk moves so that they get it from each other instead of from me.

Interestingly, in her reflective journal notes on Jane’s following lesson, the coach remarked that Jane appeared to be much more mindful of the balance of teacher-student talk and had implemented several changes to avoid “saving” students; for example, she had other students recap text events (rather than doing this herself) and she used ‘turn and talk’ (i.e., students talking to the person next to them) to allow students to grapple with a section of the text she anticipated as being potentially tricky. In one instance, when confronted with some misconceptions, the coach noted that Jane did begin to ask students closed questions (i.e., falling into old habits) but then seemed to “catch herself” and back off this strategy, instead using talk moves and small group discussions to give students time to work through the information themselves. The following Excerpt (Table 21) from Jane’s second coaching video, where students discussed a passage from “A Long Walk

to Water” describing how the main character (Salva) encountered a stranger after having been abandoned by traveling companions, illustrates this improvement:

Table 21 Classroom Discussion Excerpt from Jane’s Second Coaching Cycle Video

<i>Turn</i>	<i>Speaker</i>	
1	Jane:	So what’s happening here? Peyton?
2	Student A:	He knows the old woman...
3	Jane:	But look at what it says: ‘would she be friendly to a stranger?’ So does it sound like he knows her?
4	Students:	No [choral answer]
5	Jane:	No. So now that we’ve got that clear, what’s happening here?
6	Student B:	He’s being friendly to a stranger that’s in the Dinka tribe.
7	Jane:	That’s in the Dinka tribe. Ok. Can you explain that a little more? (silence). How about someone else? Marcy?
8	Student C:	He saw someone outside his group and he’s trying to approach her and...[trails off]
9	Jane:	OK let’s think about that...let’s go back to that section you all seem to be stuck on. It says she’s a stranger. But he calls her auntie. Turn and discuss for a minute with your partner...why? What’s going on here? Do some thinking with each other and then we’ll come back together (<i>students engage in small group discussion ~1 minute</i>)
10	Jane:	Ok what did you discuss? John?
11	Student D:	I think in Africa they call people they don’t know “Auntie” or “Uncle” instead of “Sir” or “Ma’am.”
12	Jane:	(<i>looks to another student</i>) You’re nodding...what are you thinking? What do you have to add to that?
13	Student E:	Maybe in the Dinka tribe they call people they know really well auntie or uncle?
14	Jane:	Hmm...so you think it has something to do with the tribe? (<i>another student jumps in</i>)
15	Student F:	But she’s a stranger.
16	Jane:	But she is a stranger...but we also know she is from the Dinka tribe... Jade what do you think?
17	Student G:	I agree with John and would like to add that I think they call someone from their own tribe “Auntie” or “Uncle” even if they don’t know them...

Jane began this exchange by asking an open-ended question (T1: “So what’s happening here?”) and was immediately confronted with a misconception (T2: “He knows the old woman”). Jane initially responded by returning to the text and asking students a close-ended question to correct the misconception (T3: “So does it sound like he knows her?”), a habit of questioning she was seeking to disrupt. Jane then re-initiates her original question, eliciting another student idea that is more sophisticated but still under-developed, and students struggle to explain the thinking

behind it (T8: “He saw someone outside his group and he’s trying to approach her and...[trails off]). Importantly, Jane responds to this impasse by pivoting to a new strategy, highlighting key pieces of information from the text and inviting students to make sense of these events in small groups (T10: “Ok let’s think about that...”). What follows is a fruitful discussion where students bring forth more considered ideas and air their thinking, with Jane skillfully deploying talk moves to support students in building off one another’s ideas (e.g., T12: “You’re nodding...what are you thinking? What do you have to add to that?”), push their thinking further (T16: But she is a stranger...but we know she is from the Dinka tribe? Jade, what do you think?) and encourage students to productively grapple with any lingering misconceptions (T14: “Hmm... so you think it has something to do with the tribe?”). Students, in turn, showed evidence of jointly resolving differing perspectives to clarify comprehension of text events (T17: “I agree with John and would like to add that I think they call someone from their own tribe ‘Auntie’ or ‘Uncle’ even if they don’t know them...”).

Taken together, the discussion interaction patterns featured in Table 21 suggest that the insights Jane gleaned from her prior coaching reflection helped inform her in-the-moment instructional decisions that led to richer thinking opportunities for her students. The balance that Jane was largely able to achieve between ‘stepping out’ of the discussion to allow students to take the lead in offering multiple interpretations of text and ‘stepping in’ to the discussion to help advance students’ thinking, suggests that she was closely attending to the substance of students’ contributions and metering her action accordingly. This suggests a tight link between Jane’s reflection-on-action – her ready interpretation of the link between her talk moves and the trajectory of student thinking, and reflection-in-action- her subsequent responsiveness to student thinking, that could explain how Jane was able to improve so rapidly in her learning and practice.

Debra

As in Jane's case, our analyses suggest a connection between the content and quality of Debra's reflections and the kinds of changes she enacted in her classroom discussions, particularly with respect to her use of literal questions as a scaffold for some of her students. Interestingly, Debra did not explicitly address the idea that some of her questioning habits were influenced by a belief that lower-level questions are necessary as a point of access for her struggling readers until her third coaching cycle. The following Excerpt (Table 22) details a video segment the coach had chosen from Debra's third lesson to discuss this issue:

Table 22 Classroom Discussion Excerpt from Debra’s Third Coaching Cycle Video

<i>Turn</i>	<i>Speaker</i>	
1	Debra:	Remember what we read before about the men? What had the men been doing [for the refugee group]?
2	Student A:	They were carrying supplies?
3	Debra:	No...
4	Student B:	They were guarding...they didn’t go to sleep at night because they were guarding [Salva’s] group?
5	Debra:	Ok...C, do you want to add on to what [Student B] said?
6	Student C:	I agree but I want to add that they knew that they would need guards so [the soldiers] took the men because they are strong
7	Debra:	Oh ok, so they took the men because they are strong...good all right, anything else?
8	Student D:	Salva again asks if he will ever see his family again... like he was doing in the last chapter...
9	Debra:	Yea it’s still the same thought right?
10	Student D:	He says it over and over again...
11	Debra:	Yea Ok [Student D] just said Salva says that he misses his family over and over again...but lets go back to what [Student C] said...[Student C] can you repeat?
12	Student C:	They took the men because they are strong...
13	Student E:	I agree when the rebels shot the guns the strong men could defend them and help Salva’s group get away...
14	Student D:	I would rather go down protecting the group [than join the rebel soldiers]...
15	Debra:	Absolutely, and what is the group now?
16	Students:	Elderly, women, and children [choral answer]
17	Debra:	Elderly, women, and children. And Salva is the only?
18	Students:	Child [choral answer]
19	Debra:	He’s the only child besides that baby, right? So how does Salva feel?
20	Students:	Pretty sad [choral answer]
21	Debra:	Pretty sad, right? So he’s having trouble falling asleep...let’s move on...

In this excerpt, Debra began by asking an unplanned closed question (T1: “What were the men doing?”) and immediately started funneling students towards a specific answer (i.e., that the men taken by the rebels had been protecting the refugee group), including shutting down the first answer she received (T2: “They were carrying supplies”) and another line of thinking that was introduced (T 11: “Yea Ok [Student D] just said Salva says he misses his family over and over again...but let’s go back to what C said...”). There is some evidence that she is attempting to employ talk moves- by, for example, inviting students to build on each other’s answers, although

this is done rather superficially (e.g., T5: "...do you want to add on..?"; T7: "... good all right, anything else?"). Moreover, the opportunities for students to construct meaning and consider multiple viewpoints was already constricted by the narrowness of the initial question- limiting the space available for students to describe how they are making sense of the text and therefore limiting Debra's ability to notice and engage with their thinking more deeply. These discussion patterns culminate at the end of this interaction, in which Debra 'wraps up' by posing three low-level literal questions, which result in one-word choral responses by the students (T15- T21).

The coach, in her written response to this video segment in the CASTL system, prompted Debra to reflect on her beliefs about the value of these types of questions by offering this as a possibility based on her interpretation of events:

...This seems to be evidence that while you have a lesson plan developed with specific stopping points and open-ended questions, you are still relying on "check-in" questions to give you a sense that students are understanding the text. This leads me to think that there may be an underlying tension in your belief system – that while you value the idea of students taking on more of the responsibility for constructing meaning and socializing intelligence, a part of you may still believe that you can't count on such instruction to do the whole job.

The coach then asked Debra to consider how her use of these rapid-fire "check-in" questions had influenced the conversation- both in terms of balance of teacher-student talk and the rigor of student contributions. In response, Debra wrote:

I feel that I do hold strong to the concepts of the framework and use the prompts as I have planned. I allow for the students to develop their understanding of the text and have opportunities for them to have discussion. There was a great discussion between two students, but as you see in the video there are still just a few students responding to the questions...So for an occasional group response

to jar the "sleeping students" [this] seems to wake up a few of them and they were able to continue on with the lesson. I did use the prompt "let's go back to what Alexis said... good and? Ok, and they have guns, right? you kind of feel like.... more??" Once the "sleeping" student were engaged they were apt to respond to the next query of "oh so how does Salva feel?"

Though Debra was, to some extent, reflecting on how her pedagogical moves were influencing students' discussion opportunities, she declined to interrogate the possibility that she held some conflicting beliefs about her questioning practices, instead offering justifications for her actions (e.g., to "jar the 'sleeping students'"). This is in contrast to Jane, who addressed this idea in her first coaching cycle without explicit prompting by the coach.

In the following post-lesson conference, Debra's view that lower-level questions are a useful tool for engaging certain students was elaborated; in particular, her belief that these kinds of questions grant access to her lower-level or struggling students was surfaced:

Table 23 Reflection Excerpt from Debra's Third Post-Lesson Coaching Conference

Debra:	It's a challenge... because I do have those four or five students that always respond. So sometimes when I have those check-in questions... it's to give everybody a voice, even though it's something so simplistic... So I know I do sometimes regress back into those closed questions, but I just want everybody to speak. So I try to do a mix of the moves and functions, but still give everyone an opportunity to say something.
Coach:	So one other thing to consider is if the really thought-provoking questions are answered by the strong students, and the closed, literal questions are answered by the struggling students, then what happens in terms of learning?
Debra:	Well, I think with the [struggling] students...the fact of the matter is that because they're involved in the lesson and they're listening to what the other students have to say... they are exposed to a wonderful enriched environment. They're just having difficulty with their own abilities and being able to respond at a high level. But those closed questions...they wake them up... I definitely think they might have an opportunity to feel that they're really contributing, since the simplistic answers will be their comfort zone. And then once the conversation starts, they might be able to contribute [along with] the students that are discussion leaders.

Despite the coach’s attempts at various points in this post-lesson conference to prompt Debra to reflect on the tension between her previously stated belief that all her students deserve rigorous questions and the assumption she is currently voicing that struggling readers need low-level literal questions, the coach felt Debra was still resistant:

[Debra] saw that she was asking yes/no questions and fill-in-the-blank questions, and adamantly did not feel that these limited the cognitive challenge for her lower level or struggling students, but rather “woke them up.” She feels that the more cognitively challenging questions are for the stronger readers. My questioning was not successful in getting her to realize the contradiction in her stated belief system (all kids deserve high level questions/can do rigorous work) and her actions. Or even that there might be a tension between two sets of held beliefs.

Importantly, this does not mean that Debra’s reflections on her practice did not improve or that those reflections did not lead to more sophisticated rejoinders to student ideas in practice. It may suggest, however, that critically analyzing the effects in practice of this particular assumption that her struggling readers need easy or low-level “check-in” questions to engage in the discussion was an especially strong barrier in her reflections- and that disrupting this particular habit was therefore also especially difficult for Debra to reflect on and change in practice (and that she could maybe use more explicit coaching around this issue). Table 24, drawn from Debra’s subsequent (Cycle 4) classroom video, illustrates this habit of practice:

Table 24 Classroom Discussion Excerpt from Debra’s Fourth Coaching Cycle Video

<i>Turn</i>	<i>Speaker</i>	
1	Debra:	So what happened?
2	Student A:	He found someone from his tribe.
3	Debra:	He found someone from his tribe...how do you know?
4	Student A:	Because of the ritual markings.
5	Debra:	Ritual markings...let’s zoom back in...explain that to me. Story?
6	Student B:	She had Dinka patterns.
7	Debra:	So there were markings on her forehead that tie her to that tribe. So do you know what ritual markings are? It’s like a tattoo or scar. You know what a scar

		is, right? So they purposefully put these markings on so people know what tribe they are from. Does everyone understand that?
8	Students:	Yes [choral answer]
9	Debra:	OK, so now we understand he's...what's going on here?
10	Student C:	He can drink some water now.
11	Debra:	Ok, he can drink some water, there's a pond. What else?
12	Student D:	There's a woman that is from his tribe and also has ritual scars...
13	Student E:	He wants to find out if this woman is nice...he's gonna walk up to her and find out.
14	Debra:	Right, yea, I would want to find out because what happened when we started this chapter? What do we know about Salva?
15	Students:	He's alone [choral answer]
16	Debra:	He's alone and now he's found a what?
17	Students:	A woman [choral answer]

Here, though this exchange illustrates some of the improvements Debra had made from her previous cycle- including more consistent use of talk moves (e.g., pressing for reasoning in T2 and T5) providing fewer explanations to students (e.g., resuming the discussion by posing another open-ended question "...what's going on here" in T9)- at the end of the interaction, we can see Debra resume the same pattern of rapid-fire literal questions that the coach had raised for discussion in her previous cycle. These findings raise the possibility of a link between Debra's seeming resistance to critically reflect on this issue during her coaching conversations- and her apparently strong belief that these questions are needed for struggling readers- and the resilience of this particular kind of questioning in her practice.

3.6 Summary and Conclusions

Our comparative case study analyses yielded several insights into how and why teachers' learning trajectories and outcomes may vary significantly in the context of a shared professional development experience. The above results specifically suggest that although Jane and Debra both

showed improvement in their professional vision and text discussion quality, Jane was able to grow across both dimensions to a substantially greater degree than Debra. Our ‘deep dive’ into both teacher’s learning and practice trajectories, combined with key insights from the coach’s contemporaneous reflections, suggest Jane was more consistently willing and/or able to critically reflect on her teaching practices, consider why she made certain teaching decisions, and make inferences about the potential influence of alternative teaching moves on students’ learning. These qualities of Jane’s participation perhaps conferred an advantage that positioned her to derive optimal learning benefits from her coaching sessions. Debra, conversely, demonstrated some persistent challenges engaging in the reflective process. As suggested by our professional vision analyses, one particularly noteworthy challenge seemed to be her relatively strong tendency to be evaluative in her reasoning, a notion also supported by the coach’s consistent observations of “defensiveness” and an inclination to justify or rationalize her teaching decisions in her reflections. As was revealed in our close analyses of the reflection-practice link in the final section of our Results, Debra’s apparent reluctance to interrogate her assumption that her ‘low-level’ students required low-inference literal questions in order to learn and participate in text discussions was perhaps her most significant obstacle to change.

3.7 Discussion

Our goal in this study was to contribute insights into the nature of the relationship between teacher reflection quality and growth in dialogic classroom text discussion practice in the context of a video-based remote coaching intervention. This effort included drawing on existing research to develop and apply a conceptually aligned set of interpretive frameworks to connect specific

teacher learning processes (i.e., teachers' noticing and reasoning around their videoed discussion interactions) and instructional quality dimensions and outcomes (i.e., creating space for, noticing, and facilitating student thinking in discussion).

In line with other recent research (e.g., Correnti et al, 2020; Sedova, 2017), our findings suggest that though teachers appeared able to readily adopt certain features of dialogic discussion at the onset (i.e., 'high-leverage' rejoinders such as pressing for student reasoning), it was only after they engaged in several cycles of coaching reflection and experimentation that they were able to effectively leverage them to elicit and grow students' thinking in discussion. As noted by many researchers, teachers often "add-in" new talk moves while still maintaining existing teaching habits – i.e., classroom discussions remain teacher-centered in nature – with no real appreciable difference in student participation (Lefstein, Snell, & Israeli, 2015). In the context of Online CFC, findings from the present study lend support to the notion that engaging teachers' joint sensemaking and analysis around their practice (in the coaching reflections) facilitates them to shift from a surface-level or 'pro-forma' grasp of dialogic text discussion practices (that they learned initially in the workshop) to a more sophisticated *functional* understanding of how to effectively deploy them in practice.

Importantly, a closer look at teachers' reflective coaching dialogues suggested that teachers' ability to notice and critically analyze the link between their specific discussion choices and students' thinking opportunities, particularly in light of an apparent discrepancy between teachers' learning goals and student contributions as evidenced in video, was an especially influential factor for shaping differential outcomes between our case study teachers. These findings echo other professional development research, particularly in the space of teacher professional vision and noticing, that have similarly noted the importance of teachers' critical thinking

regarding their instructional decisions and interactions with students for developing new teaching skills and dismantling problematic existing practices (van Es, 2011). Our study builds on this research and brings additional insight by highlighting and exploring, on a fine-grained level, the social dynamics involved when a coach and teacher are jointly making sense of a specific teaching-learning discrepancy or problem. In particular, our case study teachers provided a fruitful contrast for examining the implications of situations where, on the one hand, the coach and teacher are relatively in sync in terms of what they see in video (in the case of Jane), and on the other, where there are some significant disconnects that cannot quite be reconciled, even though coach and teacher are viewing the exact same video and espouse similar (explicit) pedagogical beliefs and commitments (in the case of Debra).

Further analyses of these coach-teacher dynamics in reflection led to what we view as one of the most intriguing insights from this study- and an especially fruitful path for future research- i.e., how Debra negotiated competing narratives and belief systems regarding students' academic ability and individual learning needs. In particular, while Debra consistently articulated an explicit belief in the learning capabilities of all her students (aligned with dialogic discussion principles), she also consistently evoked ability-hierarchy assumptions (aligned with traditional conceptions) when reflecting on her specific classroom interactions, especially when discussing her teaching decisions relative to the learning needs of her lower-performing students.

One remarkable pattern was the apparent resilience of these narratives in Debra's thinking during reflection, despite multiple attempts by the coach to nudge her to interrogate these inconsistencies and consider the consequences for students relegated to the margins of the discussion. This may signal an especially entrenched lay theory or belief about the kinds of thinking and reasoning processes students- and especially struggling or low-performing students-

are capable of as they learn to comprehend text. One critical implication of these beliefs is that they translate into differential definitions of what qualifies as ‘rigorous thinking’ for perceived ‘high’ vs. ‘low’-level readers (i.e., higher expectations for higher level readers) (Brophy & Good, 1970; Rubie-Davies, Peterson, Sibley, & Rosenthal, 2015; Rubie-Davies, 2010). Not only would this shape how teachers made sense of their classroom noticings and influence the quality of their interactions with students, but it would also obstruct their ability to analyze and interpret the relationship between their teaching moves and student learning through the lens of dialogic teaching principles and goals in reflection. That is, if these tacit beliefs are evoked as a result of, e.g., a coach encouraging a teacher to notice a disparity in the learning opportunities she provides for certain students, it would be difficult for a teacher to reflect on how talk moves could be used to support rigorous discussion to benefit the learning of all students.

What makes Debra’s case so interesting, and what we believe could contribute some nuanced insight into the wealth of research exploring the influence of deficit-based perspectives and ability-related stereotypes and biases in teaching (see, e.g., Snell & Lefstein, 2018; Boaler & Staples, 2008; Steele & Aronson, 1995; Phillip, 2011; Black, 2004; Calabrese Barton & Tan, 2018), is the complicated ways in which she navigated and attempted to reconcile her deficit-oriented statements in reflection, her stated beliefs in the capabilities of all her students to engage in rigorous discussion, and her inadvertent but sustained undermining of ‘low-level’ students’ learning through teaching practices she continually defended and justified in reflection. Specifically, though her reflections did at times echo deficit narratives, they may have also been driven by a more pedagogical content-oriented belief or ‘lay theory’ that assumes learning develops in a strictly linear fashion (Louie, 2020). Thus, Debra may have also been making a ‘professional calculation’ that it would not be appropriate to ask students who did not appear to

have mastered basic reading skills (as evidenced by, e.g., low participation or test scores) to engage in high-level thinking and comprehension processes. Indeed, there were indications of this kind of belief in her reflections about, e.g., the benefits to her ‘lower-level’ readers of experiencing a rigorous discussion environment, even if they are only passively or rotely engaged (see the final Results section). Moreover, Debra consistently expressed a great deal of care and concern for her students, and her stated beliefs in the capability of all her students (though undermined in practice), appeared to have been made in good faith. Whatever the case, on a practical level, adopting a more nuanced (and perhaps sympathetic) perspective of Debra’s intentions and actions would likely be a more fruitful approach if the goal is to facilitate robust teacher change and growth (Lowenstein, 2009; Philip, 2011).

3.7.1 Contributions and Future Directions

One advantage of the present study was our development of closely- aligned outcome measures- i.e., our three indicators of text discussion quality- in connection to hypothesized teacher learning process measures- i.e., professional vision dimensions in teachers’ reflective dialogues. Thus, our analyses of teachers’ first (just after their first videoed lesson) and third (just prior to their fourth videoed lesson) post-lesson reflective dialogues using our professional vision framework enabled us to capture authentic (i.e., in situ) indicators of teacher learning in close proximity (conceptual and temporal) to targeted outcomes. Moreover, because we also drew on a key contemporaneous data source (i.e., the coach’s journal entries) to supplement our analyses through the lens of these frameworks, we were enabled a more contextualized and comprehensive view of our case study teachers’ development. Importantly, results suggest that our professional vision reflection and text discussion practice quality dimensions all ‘hung together’ (i.e., shifted

in expected directions) as evidenced by the fact that, while Jane and Debra varied considerably in their levels of improvement over time, this variation appeared to be more related to degree rather than type. While further research is needed to validate and further explore these shifts with larger samples, these results are encouraging and signal the promise of these measures for capturing meaningful changes in the quality of teachers' learning and classroom practice.

One contribution of our outcome measures in particular was our use of a more fine-grained analytic framework, adapted from existing measures (i.e., the IQA/ATM measures of text discussion quality, Matsumura, Garnier, Slater, & Boston, 2008; Matsumura, Garnier, & Spybrook, 2013; Correnti et al., 2015) to capture more targeted and precise shifts in the quality of teachers' text discussion interactions. We highlight in particular our use of proportions (i.e., dialogic uptake moves relative to other rejoinders) in analysis as a more robust approach than the use of simple frequency 'counts', as the presence of dialogic talk moves alone does not guarantee dialogism in practice (Alexander, 2006; Sedova et al., 2016), and 'more' isn't always 'better'- i.e., a teacher who, for example, asks more open-ended questions overall isn't necessarily achieving better student participation than a teacher who asks fewer open-ended questions overall (Lefstein et al., 2015). Most notably, our measures of student text discussion quality add to a growing base of research emphasizing the quality of students' discussion participation (in addition to other standardized outcome measures) as critical for advancing our understanding of the relationship between specific discussion moves and practices and students' engagement in a 'truly' dialogic discussion (Boyd & Markarian, 2015). Thus, our hope is that this framework can be leveraged for future research to provide a more nuanced and theory-aligned (or 'sensitive') measure of key text discussion quality dimensions for teachers engaged in similar PD efforts.

Our in-depth analyses of teachers' reflections, however, also revealed a key limitation of just considering changes in students' overall text discussion quality, even in the context of using more fine-grained measures. Our analyses around Debra's case in particular suggest the possibility that observed improvements in the quality of her students' discussion participation may have been largely driven by the 'high-level' students whom she appeared to focus the bulk of opportunities to lead the discussion and share their thinking. Though it was beyond the scope of this study to make any strong conclusions on this score, it does raise an important consideration for researchers to attend to the quality of students' discussion participation both collectively and at the level of individual students- especially if we are to advance principles of equity and inclusion that are foundational to dialogic teaching (Alexander, 2017; Outlaw, 2021). One contribution of this study is that it illuminates one path for researchers to explore these questions- i.e., by analyzing how tacit beliefs may emerge in teachers' reflections, particularly when there is video evidence of disparities in their practice- that might obstruct their progress towards achieving these goals.

3.7.2 Limitations and Practical Implications

Of course, there are a number of limitations to consider in interpreting the results of this study. Specifically, though our findings suggested a close link between the quality of our case study teachers' reflections and classroom practice as measured by professional vision and text discussion quality frameworks, we cannot generalize these results to other teachers or coaching contexts. Moreover, it is important to acknowledge that we cannot rule out the possibility that other factors may have influenced the changes we saw in the quality of teachers' reflections, the quality of their classroom discussions, or the relationship between the two. Notably, however, both case study teachers reported that Online CFC was the only literacy coaching they participated in for

that school year, and that they had received no professional development specifically focused on dialogic text discussions for reading comprehension. Hence, it does not seem plausible that other learning experiences aside from our program would likely explain observed changes in teachers' reflections and text discussion quality. Most significantly, as mentioned previously, our primary goal with this study was to generate insights into a theory of teacher change to be leveraged and studied with different samples in similar PD contexts.

Finally, in addition to the number of potential directions for future research discussed throughout this section, the results of this study could be of interest to those designing reflection-based teacher PD. Researchers have often noted the importance of supporting teachers to adopt an 'interpretive stance' in reflection, establishing non-evaluative norms in reflective dialogues, and actively guiding teachers to notice and interpret significant features of their classroom interactions (Borko et al., 2008; 2011). The coach in our study made efforts to facilitate this kind of context in several ways, including, e.g., using written reflective prompts to model evidence-based reasoning and asking teachers what they notice about the impact of their question choices on student discussion quality. Importantly, our case study analyses suggest that the effectiveness of these kinds of supports may vary in systematic ways between teachers. Debra's case, for example, suggested a highly evaluative stance and reluctance to question the inadvertent effects of her teaching-learning assumptions and decisions. In future implementations, this information could be systematically collected and used as an ongoing source of formative assessment for the coach (i.e., to determine that more explicit efforts were needed to address Debra's evaluative stance and tacit assumptions). Thus, a critical focus of further research would be to develop coach training and resources- including knowledge of the different kinds of questions and prompts coaches can use to respond to teachers' initial thinking and tendencies in reflection- to support coaches to 'meet

teachers where they are' and more effectively address individual teacher learning needs and progressions.

In conclusion, coach-guided video reflection is a promising practice for developing teachers' learning of new and challenging forms of instruction, including dialogic text discussions. Although growing research suggests the promise of well-designed, comprehensive coaching interventions for improving a variety of literacy teaching and learning outcomes, there is comparatively little understanding of the teacher learning processes that link to specific dimensions of text discussion quality. From the present study we conclude that a professional vision framework is a promising tool for assessing and understanding the nature of our case study teachers' learning in this PD context, and how the quality of this learning in turn influenced their extent of growth in text discussion quality. Taken together, we believe the results of this study represent a step forward in opening the "black box" of coach-teacher reflective dialogues to enhance teacher learning theory and process-oriented empirical research.

4.0 Study 3: Mental Simulations to Advance Adaptive Teaching Expertise in Expert-Guided Reflection

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Abstract

Teachers today are increasingly required to enact complex instructional reform practices that center student thinking and discussion at the heart of classroom activity. Such practices require *adaptive* expertise in which teacher actions and instructional decisions hinge on constantly shifting instructional contexts and student learning needs. How can teachers be supported to effectively and efficiently develop such adaptive expertise? To answer this question, we first characterize why developing such expertise is difficult for teachers absent significant support. We then present the Framework for Adaptive Teaching Expertise (FATE), which, based on a synthesis of cognitive and situated learning theory research, summarizes the key ‘functions’ or learning processes involved in the design of expert-guided reflection contexts that support robust teacher learning. Next, we present one kind of expert-guided teacher learning routine, Mental Simulations for Teacher Reflection (MSTR), that concretely instantiates FATE in the context of instructional coaching professional development (PD). We illustrate what such mental simulations look like across disciplinary contexts (i.e., Math and ELA), and then describe what high quality mental simulations ‘look like’ and how they support teacher learning. Finally, we present an exemplar vignette of coach-teacher dialogue to illustrate and provide in-depth analysis and discussion of an ‘ideal’ implementation of MSTR. We offer these two frameworks (FATE & MSTR) as models for theorizing and studying mechanisms of teacher learning in professional development contexts with similar goals and design principles.

4.1 Introduction

Modern professional work often requires the ability to flexibly and efficiently adapt to evolving work conditions and unanticipated problems (van der Heijden, 2002). Classroom teaching is increasingly recognized as this kind of professional domain (Carbonell et al., 2014; Darling-Hammond, 2010). One major factor catalyzing this shift is the growing embrace of ‘student-centered’ instructional approaches that situate student agency and dialogic interaction at the heart of classroom activity (Sherin & van Es, 2009; Sun & van Es, 2015). These models—variously described as ambitious or responsive instruction (Ball & Cohen, 1999; Levin, Hammer, Elby, & Coffey, 2013), problem-based learning (e.g., Goodnough & Cashion, 2006), or dialogic teaching (Alexander, 2006)—have proliferated across content areas. At the core of these models is a shared emphasis on a teachers’ ability to read, interpret, and flexibly respond to students’ ideas and developing thinking in the midst of instruction (van Es & Sherin, 2002).

The concept of adaptive expertise (Hatano & Inagaki, 1986) is often invoked to describe this kind of teaching acumen. Accordingly, much research has sought to identify the kinds of teaching competencies, dispositions, and practices associated with adaptive teaching expertise (Carbonell, 2014). These skills are often defined in contrast to those associated with ‘routine expertise,’ characterized by highly developed procedural knowledge that enables fluent and efficient task performance but lacks capacity to adapt to novel situations (Hatano & Inagaki, 1986). The bulk of K-12 classroom instruction today is still shaped by transmission-style teaching methods (Resnick et al., 2015) and are often implemented as routine expertise forms of teaching (i.e., the same teaching activities across varied situations).

The stability of teacher-centered norms and practices, even in light of considerable reform efforts, places ambitious demands on professional development to effectively disrupt entrenched

practices and cultivate teachers' adaptive knowledge and skill for new ways of thinking and acting in their classrooms. Informed by socio-cultural and situated learning theory, research has considerably progressed in recent decades to develop 'high leverage' practices for teacher learning such as expert-guided reflection and experimentation with new instructional practices (e.g., Borko, Jacobs, Eiteljorg, & Pittman, 2008; Osborne et al., 2019). Specifically in the context of student-centered instructional reforms, this has also included notable work to, e.g., develop teachers' 'professional vision' for noticing and organizing their instruction around student thinking (e.g., Sherin and van Es, 2009; Borko et al., 2008). Despite broad agreement that adaptive expertise is an important goal for teacher learning (Manniko & Juso, 2019), however, research to understand the nature of its development, and how to deliberately cultivate these processes in practice, is still relatively thin (Carbonell, 2014). This issue is perhaps most strongly apparent in the widely uneven and varied outcomes we continue to observe both within and across teacher learning intervention efforts and designs (TNTP, 2015; Major & Watson, 2018). Absent greater efforts to theorize and study teacher learning processes and mechanisms in-depth- what has often been called the 'black box' of teacher learning (Correnti & Rowan, 2007)- we are unlikely to better understand and effectively redress this issue.

Here, we propose expert-guided *mental simulations* as one routine for developing teachers' adaptive expertise in the context of reflection-based professional development. We specifically argue that mental simulation, as a systematic routine for engaging 'what-if' reasoning processes to infer and predict cause-effect relations in situations of uncertainty, can be well-suited to the context of teachers learning student-centered instructional practices. We further situate this proposed framework in connection to explicit teacher learning principles and features associated with a type of learning context widely seen as essential for effective professional development—

namely, expert-guided reflection on teaching practice. Our goal is to contribute a theory-driven approach to the study of teacher learning processes that can be leveraged across professional development contexts with similar teacher learning design principles and instructional model goals.

We present our argument for mental simulation in three sections. In the first section, we carefully characterize the teachers' learning challenge (adaptive expertise for student-centered teaching). In the second section, we present and argue for a new framework, FATE, that characterizes what an effective teacher learning context must include. We then turn to our third section that describes and argues for mental simulation as one powerful instantiation of FATE. This section shows what mental simulations typically look like across instructional coaching contexts, how the key components of mental simulations work to produce teacher learning, and what characterizes high quality teacher learning within each of those components. We conclude with a vignette of to show the complexity and richness of expert-guided teacher reflection that supports the development of adaptive expertise in teachers.

4.2 Theoretical Framework: Developing Adaptive Expertise for Student-Centered

Instruction

Adaptive expertise is generally characterized by the extent to which an individual can flexibly and efficiently marshal the declarative ('knowing what'), procedural ('knowing how') and conditional ('knowing when and where') knowledge relevant to a professional domain of practice. Adaptive experts "understand when and why to use particular procedures and can associate them with a set of underlying goals that guide their use." (Ghoesseini et al., 2015, p. 464).

Originally coined by Hatano and Inagaki (1986), the terms ‘routine’ and ‘adaptive’ expertise are often invoked to identify the distinct types of knowledge, skill, and dispositions associated with different types of expert performance. Routine experts hone and master a specific, relatively rigid set of procedural skills or ‘core competencies’ that they can execute with greater and greater efficiency over time (Bransford et al., 2005). Adaptive experts, in contrast, often revisit, revise, and shift their practices in significant ways over time, “continually expand[ing] the breadth and depth of their expertise (Bransford et al., 2005, p. 49).

Critically, for adaptive experts, this process of iteratively questioning and adapting existing practices involves reflecting upon, and possibly restructuring, fundamental ideas, concepts, and beliefs—a highly effortful and deliberative exercise that can be cognitively and psychologically taxing (Bransford et al., 2005; Chi, 2008). Developing adaptive expertise thus entails periods of reduced efficiency as existing practices are iteratively questioned and revisited, but with a greater long-term payoff in the form of a more sophisticated knowledge and skill base that enables both increased flexibility and increased efficiency in future situations (Schwartz, Bransford, and Sears, 2005).

Though the distinctions between ‘adaptive’ and ‘routine’ can be a useful schematic for the range of knowledge and skills implicated in different types of expert performance, it can also encourage, unproductively, the view that these are mutually exclusive competencies. As many researchers have pointed out, routine and adaptive expertise are not so much diametrically opposed ends of an expertise ‘continuum,’ as they are (in ideal circumstances) complementary developmental processes (Genter et al., 1997; Bransford et al., 2005; Manniko, 2019). In other words, while routine experts can remain as such and still, given the right circumstances, perform

well over time (i.e., high efficiency, low innovation), adaptive experts must develop both adaptive and routine expertise to maintain expert performance (i.e., high innovation, high efficiency).

A key factor for understanding the nature of these different types of expertise is that expert performance is inextricably linked to context: i.e., the task demands, conditions, situations, and social dynamics that comprise a particular problem space or domain of practice. On the one hand, highly stable and well-defined tasks or domains that call for speed and efficiency above all else, with little to no need for reflection outside of rote experience, are well-suited for the sole application of routine expertise (Hatano & Inagaki, 1986; salomon). Expert performance in highly complex and variable tasks or domains, in contrast, requires the requisite knowledge structures (conceptual, procedural, and conditional) to flexibly solve problems and make well-informed decisions in light of novel challenges or elements of uncertainty. In such conditions, adaptive expertise is essential for expert performance.

Teaching is one such domain that calls for a potent combination of professional knowledge and procedural skill. Education researchers have long recognized that effective teachers need a robust base of conceptual (or ‘content-based’) knowledge as well as a strong grasp of how to leverage this knowledge most effectively to develop novices’ learning in practice (Shulman, 1987). The intellectual and practical dimensions of teaching expertise have only been brought into sharper relief with the arrival of student-centered (‘SC’) instructional reforms defined by classroom practices (e.g., structures, routines, tasks, and talk) that are primarily organized around eliciting and growing student thinking. Expert facilitation in this context notably implicates a highly developed and flexible knowledge and skill base to balance careful planning and forethought around ‘structural’ lesson elements (e.g., classroom tasks and routines) with adaptive dexterity to make wise in-the-moment decisions and problem solve around ‘fluid’ lesson elements (e.g.,

interpreting and responding to student inputs). SC teaching is in this sense a prime example in which the integrated development of conceptual and procedural knowledge is vital for advancing adaptive expert performance (Bransford et al., 2005; NRC, 2000; Manniko, 2019; Ghouseini et al., 2015; Grossman, Hammerness & McDonald, 2009; Manniko & Juso, 2019; Lampert & Graziani, 2009).

The ambitious nature of these models is manifest in the wide array of classroom practices, norms, and routines that teachers must skillfully weave together to achieve an instructional context that is truly ‘student-centered’ in nature. Classroom discussions that actively elicit and engage students’ thinking represent one such foundational SC instructional practice across content areas (Grossman, et al., 2009; Sun & van Es, 2015). These discussions feature discourse patterns that aim to shift ‘intellectual authority’ to students, elevate and explore a diversity of perspectives, and encourage students to ‘take the helm’ to meaningfully shape the trajectory of classroom discussion and activity (Nystrand, 2006; Alexander, 2017; Lefstein & Snell, 2019). They are also generally characterized by a commitment to high standards of academic inquiry, where students are expected and encouraged to grapple with complex academic concepts; think critically about ideas put forth by their peers and other sources; and explain and justify their claims by way of rigorous argumentation and evidence-based reasoning processes (Resnick, Asterhan, & Clarke, 2015).

In practice, this necessitates teachers to simultaneously create dialogic ‘space’ for students to air their thinking, exchange ideas, and lead the discussion, while also knowing how and when to deftly ‘step in’ with talk moves to elicit, respond, and grow the substance of students’ individual and collective thinking. These demands highlight the multifaceted challenges of student-centered teaching: The “problem of complexity”—identifying and interpreting students’ thinking relative to learning goals in the midst of instruction; and the “problem of enactment”—having a firm grasp

of discussion routines and talk moves (e.g., asking students open-ended questions to elicit their thinking; pressing students to explain the reasoning behind their claims) to achieve student-centered learning goals in practice (Ghosseini et al., 2015).

Contrary to this vision of adaptive teaching expertise, the bulk of K-12 classroom activity today is still shaped by transmission-style assumptions that directly undercut these instructional goals and principles in practice (Snell & Lefstein, 2018). Rooted in a long history of behaviorist-oriented thinking in education, these assumptions and associated practices (e.g., the pervasive I-R-E classroom talk pattern of teacher initiation, student response, and teacher evaluation of student response) encourage a view of effective teaching as the faithful and efficient execution of highly specified instructional tasks and routines. As a result, a general orientation towards classroom instruction as the successful ‘passing on’ (or ‘transmission’) of knowledge from teachers to students has cultivated in traditional conceptions of teaching (Reznitskaya & Wilkinson, 2015; Tyack & Tobin, 1994). Notably, adaptive expertise is largely superfluous in this context, as routine expertise alone—or the pursuit and refinement of procedural skill to master a standardized set of instructional practices and routines—is a logical paradigm for teaching proficiency from this perspective.

Classroom routines and activity patterns embedded in the basic structure and flow of teachers’ lessons can be particularly problematic for developing adaptive expertise, as they are often reinforced by the cultural norms and practices emblematic of traditional school and classroom life (Tyack & Tobin, 1994). Research suggests, for example, that classroom discourse, as a ubiquitous feature of all classrooms, can in this sense be especially prone to tacit or rote enactment. The persistence of this challenge is underscored by the fact that teachers often ‘tack on’ SC instructional features or practices without actually integrating them as intended to achieve

pedagogical goals in practice (Lefstein, Snell, & Israeli, 2015; Sedova, Sedlacek, & Svaricek, 2016). Teachers might, for example, begin to ask students more open-ended questions but persist with old discourse habits (e.g., evaluating students' responses and 'filling in' close-ended questions) or deploy them in sporadic and non-purposeful ways (e.g., pose open-ended questions in reference to minimal or low-inference information). As well-established classroom routines such as teacher-student talk norms and questioning practices become increasingly automatized and implicit over time, they become more and more inaccessible to teachers as objects of critical inquiry and reflection. This is particularly the case when the resulting outcomes of well-practiced routines have for so long been judged, either explicitly or implicitly, as adequate or tolerable- in which case the teacher is likely to either ignore or assimilate deviant outcomes (Spillane, Reimer, & Reiser, 2002; Bransford et al., 2005) or search for other factors outside of their teaching actions (e.g., student background or learner characteristics) to which they can attribute or invoke in explanation of undesired outcomes (Chi & Roscoe, 2002).

A critical takeaway here is the notion that classroom procedures—habits, routines, and other patterns of practice—can actively work against adaptive expertise when they either develop irrespective of, or over time become untethered from, the conceptual underpinnings that link them to specific instructional principles and goals for student learning (Stigler & Thompson, 2009). Ideally, teachers can 'unlearn' entrenched practices when they are supported to see, from a new, 'cause-effect' perspective (Sun & van Es, 2015), how a long-relied upon routine actually fails to produce the desired outcomes, signaling to the teacher the need to reflect on prior assumptions and make adjustments (Hammerness et al., 2005; Manniko, 2019). Questioning and restructuring core pedagogical beliefs, which often link to larger personal and professional values and ideals, is of course never an easy or straightforward task. Thus, it is essential that teachers have developed the

reflective skills and disposition to consciously deliberate and continually learn from their practice (Tsui, 2009).

In sum, adaptive expertise is central to the very nature of current reform pedagogy and there are a variety of reasons that teachers, on their own, will have a hard time developing this kind of adaptive expertise. Figure 2 (below) illustrates the basic teacher learning challenge from this perspective, outlining key takeaways from the literature that we view as particularly consequential for developing SC teaching expertise. As we will argue in subsequent sections, the nature of these challenges suggests teachers will need some kind of expert guidance in order to effectively and efficiently develop the requisite knowledge and skill for this kind of instruction. In line with decades of teacher learning scholarship and research (Dewey, 1993; Schon, 1983; Rodgers, 2002; Loughran, 2002; Tannebaum, Hall, & Deaton, 2013), we specifically emphasize expert-guided *reflection* that engages teachers' critical thinking and reasoning about their practice as essential for ongoing teacher learning and professional growth (Kennedy, 2016; 2019; Darling-Hammond, Hyler, & Gardener, 2017).

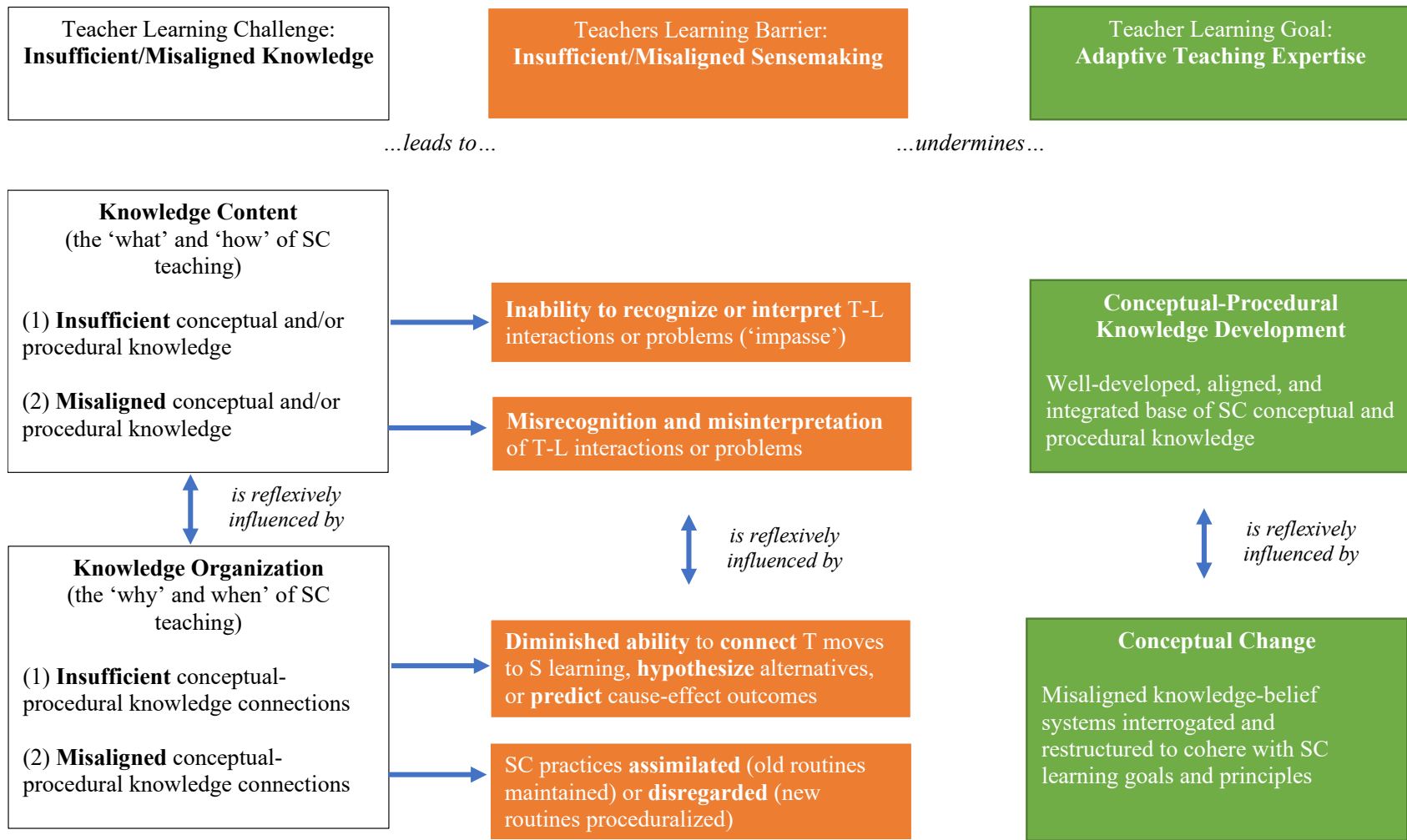


Figure 2 Defining the Basic Teacher Learning Challenge

In the next section we take up the issue of what will need to be part of expert-guided reflection- what we characterize as key ‘functions’ of the teacher learning process- if teachers are to successfully develop adaptive teaching expertise. We summarize these key learning functions in our Framework for Adaptive Teaching Expertise (FATE). As we detail below, FATE is informed by a synthesis of research on practice-based teacher learning and professional development and the development of domain-specific expertise. For the first strand of research, which draws primarily from sociocultural and situated learning theory perspectives, we particularly focus on developing teachers’ ‘professional vision’ (or ‘teacher noticing’) (Sherin & van Es, 2009) through collaborative reflection and discussion around classroom video. For the second strand of research, which draws primarily from cognitive and psychological perspectives, we particularly focus on the processes involved in individual-level knowledge development and conceptual change. This discussion in turn establishes the foundation for our proposed mental simulation framework (detailed in the second half of this paper) where we describe mental simulations in depth and demonstrate how a mental simulation routine can embody these key functions for facilitating adaptive teaching expertise.

4.3 Framework for Adaptive Teaching Expertise (FATE)

Our Framework for Adaptive Teaching Expertise (FATE), described below, answers the basic question: What are the key functions of a teacher learning experience that we would hypothesize are essential for developing adaptive SC teaching expertise? Drawing from key teacher learning and cognition research, we specifically highlight three key functions that the literature suggests are integral for developing adaptive teaching expertise: (1) Recognizing and

Interpreting Ambiguity in Teaching-Learning (T-L) Situations; (2) Recognizing and Interpreting Discrepancies between Learning Goals and Outcomes; and (3) Developing an Organized System of Knowledge to Link Specific Instances to Abstract Representations.

In what follows, we provide an overview of each key function as they relate to SC instruction, discuss why they pose a challenge for teachers absent intervention, and (briefly), describe the implications of each for effective expert-guided reflection in teacher PD. At the conclusion of this section, we provide a concept map (Figure 3) along with bulleted summary of the specific processes and relationships that link each key FATE function to a larger theory of change. Finally, we provide a brief summary and diagram (Figure 4) of the principal barriers or obstacles discussed below for each FATE function, clarifying the focal ways in which teachers will likely need to be supported in professional development practice.

4.3.1 Key Function 1: Recognizing and Interpreting Ambiguity in Teaching-Learning

Situations

Classrooms are inarguably highly complex spaces rife with complicated social dynamics. Particularly through the lens of SC learning goals and principles, a certain level of *ambiguity* or uncertainty is endemic in all teaching-learning interactions (Resnick et al., 2015; Tekummru-Kisa & Stein, 2014). This fundamental unpredictability implies that any view of teaching as relatively stable, predictable, and unambiguous (Manniko, 2019), represents an over-simplification or standardization of teaching that does not reflect its true character in practice (Dewey, 1933). As such, cultivating a ‘vision’ of classroom teaching as inherently complex and ambiguous is foundational to developing adaptive teaching expertise, a notion captured by our first key function: Recognizing and Interpreting Ambiguity in Teaching-Learning (‘T-L’) Situations.

Critically, the experience of ambiguity or uncertainty is generally an unwelcome one that people naturally strive to avoid it in most situations (Namkoong & Henderson, 2019). This motivation to ‘pare down’ or eliminate as much uncertainty as possible is especially salient when an individual lacks the tools to effectively navigate and solve problems in volatile situations. Applied to the domain of teaching, this uncertainty could feasibly compel teachers to seek and maintain tight control over classroom activity. Well-defined and familiar classroom procedures, further reinforced by a K-12 context that has long acculturated teachers to view classroom teaching in procedural or formulaic (‘transmission-style’) terms, enable teachers to remain within the confines of relatively ‘known’ and established classroom interaction and activity routines. These lesson features and norms provide an ‘ordering’ to classroom activity that reduces uncertainty but artificially masks the ‘buzzing, blooming’ complexity of teaching and learning (Jacobs, Lamb, Philipp, & Schappelle, 2011). From a teacher learning perspective, these instructional ‘scripts’ in tandem with other curriculum supports (e.g., teacher edition text books) essentially ameliorate the need for teachers to acknowledge instructional ambiguities- in effect attenuating the need to develop the adaptive skills to effectively manage them.

Student-centered instruction thus inherently entails “complexifying teaching and learning” (Ball & Cohen) in such a way that ambiguity not only be recognized but embraced as an essential aspect of the work. As a feature of adaptive teaching expertise, this notion has also been articulated as having the disposition for, and ability to, “problematize the unproblematic” (Tsui, 2009) and recognize that multiple interpretations of any particular T-L situation (or ‘instance’) can be inferred depending on varying instructional goals and contexts. As a teacher learning goal, these skills can only be achieved when teachers assume an inquiry-focused, interpretive ‘stance’ in their thinking

about their practice, ‘slowing down’ to methodically decompose and analyze their teaching interactions from new perspectives (Rodgers, 2002; Borko, 2008; van Es & Sherin, 2002).

The significance of teachers adopting an interpretive stance in reflection is a notion widely embraced by teacher learning researchers, particularly in the context of practice-based PD (Sherin & van Es, 2009; Sherin & Han, 2004; Tekkumrru-Kisa & Stein, 2014). This research is often linked to the concept of ‘professional vision’ or ‘noticing’ in the domain of teaching (Goodwin, 1994; Sherin & van Es, 2009; Sherin, 2007), an area of research increasingly embraced in the era of SC instructional reforms (van Es & Sherin, 2008; Jacobs et al., 2011). Informed by sociocultural and situated learning theory, professional vision in teaching practice is often conceived as a kind of ‘applied knowledge’ for identifying (‘noticing’) and making sense of (‘interpreting’) classroom phenomenon especially consequential for student learning goals and outcomes (Stürmer, Seidel & Holzberger, 2016). In terms of the first FATE function, the key idea here is that teachers must first learn to view their T-L interactions as inherently open to interpretation if they are to develop the skills to recognize (or ‘notice’) T-L ambiguities and interpret them through the lens of SC learning goals and principles.

Importantly, research suggests that when individuals make sense of ambiguous or uncertain situations (i.e., ‘interpret ambiguity’), they are naturally inclined to engage in causal reasoning or ‘abstract thinking’ processes (Trickett & Trafton, 2007) as a way to reduce causal uncertainty. Thus, once an individual recognizes an ambiguity, a ‘search’ is initiated for a more abstract or generalized causal explanation for specific phenomenon (Trickett, Trafton, Saner, & Schunn, 2007) a process that, in theory, is beneficial for learning (Reed, 1993). However, these reasoning processes are typically automatic and unintentional in nature, often leading individuals (including teachers), to infer spurious causal connections and draw ill-informed conclusions about

cause-effect relationships (Namkoong & Henderson 2019). Moreover, individuals are naturally motivated to interpret situations in such a way that reinforces, rather than challenges, prior assumptions. Applied to classroom teaching, a teacher might be inclined to, for example, accept a certain amount of lagging student participation or low performance as an inevitability based on the assumption that some students just inherently lack the interest or capacity to engage with complex academic content. This perspective in turn would resolve the ‘ambiguity’ of observed variation between ‘high’ and ‘low’ performing students as an independent ‘fact’ (outside the purview teacher actions and efforts) rather than as an instructional discrepancy to be explored and addressed (see FATE function 2, discussed below). Notably, this kind of interpretation also imposes a straightforward sensemaking ‘heuristic’ that simplifies the inherent ‘messiness’ of T-L situations- and diminishes the need for teachers to recognize ambiguity in future lessons.

As such, building new knowledge and insights from practice requires an expert-guided reflection context that actively guides teachers to recognize and interpret previously obscured or unexamined instructional ambiguities through the lens of SC learning goals and principles. To support recognizing T-L ambiguities, it is critical for an inquiry-focused orientation to be purposefully cultivated in reflection, as this would not passively emerge from a learning context (e.g., teachers viewing and discussing their classroom video) (van Es, Tunney, Goldsmith, & Seago, 2014). With respect to interpreting T-L ambiguities, a key role for an expert facilitator is to activate and scaffold teachers’ explicit and conceptually aligned causal reasoning processes in order to support well-informed inferences about the relationship between their instructional choices and students’ thinking opportunities.

Of course, how a teacher perceives and assesses cause-effect dynamics within a particular classroom situation reflexively influences, and is influenced by, existing knowledge and belief

systems. Thus, recognizing and interpreting ambiguity in T-L situations can be hindered both by inadequate or misaligned knowledge and beliefs (an issue especially taken up in our discussion of the third FATE key function) as well as the natural tendency for individuals to engage in automatic (rather than explicit and considered) and self-reinforcing (rather than self-challenging) abstract thinking and causal reasoning processes. In the next section, we discuss these teacher learning processes and challenges in the context of a more specific kind of T-L ambiguity, namely in situations where an explicit disconnect (or ‘discrepancy’) exists and needs to be addressed in order to achieve parity between SC learning goals and outcomes.

4.3.2 Key Function 2: Recognizing and Interpreting Discrepancies between Learning Goals and Outcomes

The second FATE function, “Recognizing and Interpreting Discrepancies between Learning Goals and Outcomes,” directly relates to and builds off of the first key function. These two functions are conceptually intertwined, as they feature a shared premise on teachers’ noticing and reasoning about the cause-effect links that bind teaching actions to student learning outcomes. The distinction is that for the second FATE function, described below, the focus is more narrowly to ambiguities that emerge relative to a particular problem context- i.e., when there is a specific, concrete disconnect between initially planned or executed actions and desired outcomes. In other words, while the first function focuses on orienting teachers to problematize their ‘vision’ of teaching-learning interactions more broadly, this one is keyed more specifically on teachers’ noticing and reasoning about the effectiveness or impact of a *particular* teaching moves, including hypothesizing potential alternatives for achieving better learning outcomes.

As alluded to previously, the ability to flexibly and effectively problem solve in the midst of instruction is critical for adaptive teaching expertise (Bransford et al., 2005). Efficiently developing these high-level cognitive skills and functions is, however, a steep challenge—particularly when coupled with the in-the-moment pressures of managing the intensity of ongoing classroom activity. Moreover, teachers work within a school and policy context that obliges significant energy and focus on achieving standardized testing outcomes and benchmarks, meaning that unanticipated problems or situations that arise in the midst of instruction are generally viewed as unproductive deviations to be ‘fixed’ as quickly as possible.

Aligning with a routine expertise perspective, this represents an “efficiency-oriented practice” that is more often about “‘problem elimination’ rather than in-depth, sustained problem solving” (Bransford et al., 2005, p. 50). In professional development research, this perspective is closely related to teachers’ tendency to adopt an ‘evaluative’ stance when reflecting on their classroom interactions (Sherin & van Es, 2009). In contrast to an ‘interpretive’ stance discussed in the previous section, an evaluative stance is focused primarily on making surface-level judgements about whether a particular T-L interaction was ‘good’ or ‘bad’ and fielding potential alternatives that could redress the situation without first carefully considering why events unfolded as they did (Sherin & van Es, 2009). Not only is this approach ill-suited for addressing T-L issues (e.g., student misconceptions) in a way that enhances students’ learning, it discourages teachers from developing the kinds of critical thinking and reasoning skills to learn from their practice and address future problems more effectively.

Dismantling and revising entrenched teaching practices to adapt to students’ learning needs therefore requires teachers to both recognize discrepancies between the ‘actual’ and the ‘ideal’ and interpret them in a way that is conducive for improving practice. However, for reasons described previously, new and potentially discordant pedagogical concepts and procedures are often liable to be ignored, superficially adopted, or reframed to fit old casts (Taylor & Crocker, 1981; Spillane,

2002; Sedova et al., 2017). Drawing from cognitive and social psychology perspectives, we highlight two key constructs, *cognitive dissonance* and *counterfactual thinking*, as especially instrumental in the process of recognizing and interpreting instructional discrepancies.

Cognitive dissonance refers to the experience of dissatisfaction or disappointment (also referred to as a ‘contrast effect’) emanating from an observed inconsistency of any particular ‘cognitive element’ (i.e., concept, belief) within a broader semantic ‘network’ (Festinger, 1997; Gawronski, 2012), including those that emerge relative to one’s intentions or desired outcomes and actual outcomes (Markman & Dyczewski, 2013). In social psychology research, these kinds of inconsistencies are viewed as serving a critical function in that they act as “epistemic cues” signaling the existence of an error in one’s system of knowledge and beliefs, “thereby imposing a ubiquitous constraint on thinking and reasoning” (Gawronski, 2012, p. 653). In this sense, cognitive dissonance specifies the kind of basic conditions or ‘mental state’ needed to productively interpret and resolve discrepancies in one’s domain of practice.

However, the mere existence of an inconsistency or discrepancy does not guarantee it will be recognized as such. In addition to potentially lacking the requisite conceptual and/or applied knowledge, individuals are also naturally motivated to avoid the negative affect associated with cognitive dissonance (Steele & Liu, 1983; Alicke & Sedikides, 2010; Gawronski & Brannon, 2019) More specifically, individuals are driven to reconcile their observations in such a way that maintains ‘cognitive consistency’ meaning that logically inconsistent or incoherent beliefs can co-exist- and even be simultaneously activated- without triggering cognitive dissonance (Festinger, 1957) Thus, inducing productive dissonance hinges on one recognizing that two or more sets of propositions cannot both be simultaneously true or false (Gawronski, 2012). In the context of teaching, teachers must therefore be equipped to meaningfully notice and recognize T-L

discrepancies- including having a concrete grasp of both the ‘initial state’ (i.e., observed or anticipated student learning outcomes) and the ‘counterfactual standard’ (i.e., desired student learning goals or outcomes)- and be motivated to interpret and resolve (rather than avoid) the inconsistencies that give rise to cognitive dissonance.

Similar to recognizing ambiguities (in FATE function 1), once established, cognitive dissonance naturally triggers causal thinking and reasoning processes to interpret and resolve discrepancies and inform future decision-making and behavior in similar situations (Trickett & Trafton, 2007). The process of *counterfactual thinking* captures the specific kind of causal reasoning engaged to interpret one or more problems in an existing set of circumstances and hypothesize solutions (or ‘counterfactual alternatives’) for inducing desired outcomes. Long viewed as playing a fundamental role in causal assessment and inference (Markman & Dyczewski, 2013), counterfactual thinking is conceived as a dynamic process where an individual’s a priori knowledge, beliefs, and expectancies are ‘uniquely reconstructed in light of a specific outcome.’ This kind of ‘what if’ reasoning theoretically supports the development of more abstract or higher-level knowledge, as it requires the mind to infer information that is missing or not precisely known and allows for the construction of multiple alternatives, which may be useful in generating predictions or explanations (Trickett & Trafton, 2007).

Thus, similar to interpreting ambiguity, counterfactual thinking can play a key role in developing new knowledge (i.e., building more robust and elaborated pedagogical schema) by enabling one to infer more cause-effect relationships and hypothesize alternatives for experimentation (Trickett & Trafton, 2007). In addition, as a process more precisely aimed at interpreting and resolving *specific* discrepancies in a domain of practice, counterfactual thinking is also particularly relevant for conceptual change (i.e., restructuring prior knowledge) when one

is obliged to elicit and scrutinize ill-informed or mis-aligned beliefs and assumptions in light of undesired outcomes.

As is also the case for interpreting ambiguities, however, the dynamic interplay between existing mental representations and particular ‘instances’ in counterfactual thinking can also be a key liability for knowledge development and conceptual change. Specifically, similar to the ambiguity ‘avoidance’ discussed for the first FATE function, individuals are inclined to perceive and attribute causality in problem contexts in ways that serve to reinforce existing beliefs and assumptions. As such, counterfactual thinking is often “directed toward establishing perceptions of avoidability and preventability than toward assessing causality.” (Markman & Dyczewski, 2013). In the context of teaching, for example, this might manifest as a disposition to attribute undesired learning outcomes to external causes or ‘traits’ (e.g., students’ inherent abilities or home life) rather than view them as direct consequences of one’s own teaching decisions and behaviors. This interpretation of dissonance would, in turn, significantly diminish teachers’ ability (and motivation) to think flexibly about the feasibility and hypothesized impacts of counterfactual alternatives.

Given these challenges, expert guidance is once again essential for cultivating a reflection context that can facilitate this teacher learning function. To encourage a productive state of cognitive dissonance, teachers need to be guided to notice and interpret an existing set of circumstances (e.g., a planned lesson routine (prospective) or an enacted scenario (retrospective)), and a desired set of circumstances. Once a shared representation of the ‘problem space’ is established, counterfactual alternatives can be systematically simulated and weighed relative to specified SC learning goals and principles. Formalizing this approach enables more purposeful and productive counterfactual thinking that can be used to explicitly guide teachers away from problematic ways of assessing causality (e.g., that T-L issues stem from inherent student traits rather than T-L context dynamics) towards an approach that is conducive for developing adaptive,

student-centered teaching expertise (e.g., there a number of teaching moves available for addressing students' learning needs).

As was the case for the first FATE key function described above, the nature of teachers' counterfactual thinking to interpret and resolve particular T-L discrepancies is inextricably linked to existing knowledge and belief systems. In particular, the nature of the inferences that teachers draw about the best (or 'better') alternatives for resolving these discrepancies depends on the content and quality of their thinking and reasoning processes that link specific teaching moves and situations to larger SC learning goals and principles. These underlying processes, which we term *instantiating* and *generalizing*, are discussed below as a component of our third key FATE function: Developing an Organized System of Knowledge to Link Specific Instances to Abstract Representations.

4.3.3 Key Function 3: Developing an Organized System of Knowledge to Link Specific Instances to Abstract Representations

Underlying both of the above FATE key functions is perhaps the most recognized hallmark of adaptive expertise: Developing strong links between context-specific features and routines and the abstract knowledge representations and concepts that give meaning to those procedures in practice (Ericsson, Hoffman, Kozbel, & Williams, 2006; Saloman & Perkins, 1989; Carbonell et al., 2014). This basic idea is captured in Hatano & Inagaki's (1986) fundamental observation that adaptive experts consistently strike a balance between practicing procedural skills and routines (i.e., developing efficiency) with explicit and ongoing efforts to build an increasingly elaborated base of conceptual knowledge to enhance adaptivity in practice (i.e., developing innovation). This process enables a mutually informed feedback loop where individuals can continually learn from

their practice and make increasingly well-informed decisions relative to professional goals (Bransford et al., 2005).

Applied to teaching, this characteristic of adaptive expertise translates as an iterative balance between, on the one hand, interpreting specific teaching moves and interactions at greater levels of abstraction and, conversely, interpreting SC learning goals and principles in terms of the variety of specific teaching moves and routines that can be enacted to achieve them. In our framework, we conceive of these processes- which we have respectively termed *generalizing* and *instantiating*- as fundamental drivers of conceptual knowledge development and conceptual change and key mediators of the causal and counterfactual thinking processes involved in FATE functions 1 & 2 (see Figure 3 below for a depiction of these relationships). In short, we view instantiating and generalizing as the foundational cognitive processes involved in explicating, questioning, and exploring specific teaching and learning dynamics through the lens of SC learning goals and principles- and as such, for advancing the collective work of FATE.

The significance of this ‘back and forth’ vacillation between developing conceptual knowledge and procedural skill is reflected in research on adaptive expertise (Hatano & Inagaki, 1986; Anthony, Hunter, & Hunter, 2015). A similar notion has also been variously articulated in the learning and knowledge transfer research, particularly with respect to ‘ill-defined’ tasks or problem spaces and cases where significant contextual ‘distance’ (e.g., temporal, spatial, social) exists between the initial learning environment and the performance or ‘transfer’ environment (e.g., “mindful abstraction” or “schema abstraction”; Salomon & Perkins, 1989; Reed, 1993; Barnett & Ceci, 2002). In the context of teacher learning, the role of instantiating and generalizing processes is reflected in research suggesting that knowledge organization- i.e., the depth and breadth of teachers’ pedagogical ‘schema’ for interpreting classroom particulars as instantiations

of a more general case or concept- is a primary factor distinguishing adaptively expert teachers (Carbonell, 2014; Bransford et al., 2005; van Es & Sherin, 2008). By simulating the impacts of multiple alternatives through processes of instantiating and generalizing, teachers can develop their knowledge of the ‘what’ (declarative) the ‘why’ (conceptual) the ‘how’ (procedural) and the ‘when’ (conditional) of SC instruction.

Critically, developing and restructuring prior knowledge and belief systems is a highly effortful process that many teachers are ill-prepared to undertake, especially in an efficiency-focused classroom environment (Bransford et al., 2005). Indeed, the assertion that teachers need opportunities to engage in deliberative reflection and knowledge development outside the pressures of the classroom is central to the design of current reform-focused teacher PD (Borko et al., 2008; Kennedy, 2016). Much of this literature has strongly advocated for video-based reflection as a means for teachers to revisit and systematically decompose their past classroom interactions (Borko et al., 2011). Researchers have especially emphasized teachers’ noticing and reasoning around key ‘cognitive’ indicators of students’ learning (Lefstein & Snell, 2011; Sherin & van Es, 2009; van Es & Sherin, 2008; Jacobs et al., 2011) and the causal links that bind teaching moves, content, and students’ thinking opportunities (Ball & Cohen, 1999; Tekmurre-Kisa & Stein, 2014). A parallel emphasis on teachers’ domain-specific knowledge of student’s concept development and learning trajectories has similarly emerged, particularly in relation to math and science (Stein, Grover & Hennigsen, 1996; Levin & Richards, 2011). Notably, these teacher learning aims closely align with the notion that teachers need to develop flexible access to robust conceptual and context-specific knowledge in order to efficiently choose and enact a course of action that optimally benefits student learning (Bransford et al., 2005).

Notably, from the perspective of adaptive expertise, there is additional significance to further extending teachers' knowledge to connect with larger instructional and normative principles in addition to student thinking and concept development (Bransford et al., 2005). Specifically, rooting teachers' learning in more abstract and content-independent learning principles enables a broader and more flexible application of "an organized system for knowing when, why, and how aspects of their competency are relevant to any particular situation." (ibid, p. 48) and increases the prospect that a teachers' conceptual and procedural knowledge will transfer across lessons and over time:

"Knowledge to be taught should be prioritized into categories that range from 'enduring ideas of the discipline' to 'important things to know and be able to do' to 'ideas worth mentioning.' Thinking through these issues and coming up with a set of 'enduring connected ideas' is an extremely important aspect of educational design." (Bransford et al 2005 p. 46).

Thus, making foundational principles explicit and clearly articulating their relevance to teachers' instructional decisions and practice builds the sophistication and complexity of teachers' conceptual knowledge and procedural skill (Bruner, 1966). The idea of connecting teachers' noticing and reasoning to larger principles- including those associated with systemic and social justice issues in teaching- has also gained increased attention in the teacher learning and PD literature (Erickson, 2011; van Es, Hand, & Mercato, 2017; Louie, 2018; Lefstein & Snell, 2011). Lampert et al. (2013), for example, posited that effective teaching involves teachers' ability to discern how their instructional practices conceptually link to larger 'normative principles' in addition to content-based (or lesson-specific) student learning goals. In their teacher education model, these include principles that commit to, for example, viewing students as thinkers and sense-makers; designing for equitable access to rigorous academic work; and grappling with the

role of schools as a democratic institution (Lampert et al., 2013). These principles are in turn linked to specific teacher practices and categories of practice such as ‘eliciting and responding to student contributions’ and ‘positioning students as competent’ (ibid, p. 228).

Once again, expert guidance is key for facilitating productive instantiating and generalizing. Absent this guidance, teachers might make erroneous generalizations and/or not have the conceptual or background knowledge to make strong connections between their teaching moves, student thinking, and larger SC instructional goals and principles. Importantly, because these kinds of ‘student-centered’ instructional principles upend traditional assumptions about classroom teaching and learning, intervention efforts must also engage teachers’ critical thinking and about their existing beliefs and practices. Otherwise, new instructional concepts and practices are liable to be superficially assimilated or re-cast to fit existing molds.

4.4 Summary of FATE Key Functions and Potential Barriers

To summarize, developing the kind of adaptive expertise needed to skillfully facilitate student-centered instruction is a significant teacher learning challenge for multiple reasons. First, it calls for teachers to shift their fundamental ways of thinking about their practice, towards a ‘vision’ of teaching and learning as an ever-evolving context for gaining new experience and insight, rather than as a static ‘target’ that can be achieved and routinized. Second, teachers must develop a strong, functional base of new conceptual knowledge (i.e., student-centered instructional principles and learning content goals) in tandem with the practical knowledge (i.e., new facilitation moves and routines) to effectively instantiate them in practice. Absent these links, teachers might know the ‘what’ and ‘how’ of effective student-centered teaching practices but lack the ability to

facilitate these in practice- i.e., knowledge of the ‘why,’ ‘when,’ and ‘for whom’ to deploy particular moves based on student cues in connection to SC learning goals and principles. Critically, this process often entails ‘unlearning’ prior practices that may have become integral and cherished as ‘tried-and-true,’ necessitating one to undertake the difficult task of “‘letting go’ of previously held beliefs and tolerate the ambiguity of having to rethink one’s perspective” (Bransford et al., 2005, p. 51). Thus, teachers might be disinclined to even recognize instructional discrepancies as such (i.e., dissonance avoidance) and, even if established, may engage counterfactual thinking processes that serve to fortify problematic beliefs and practices rather than compel teachers to examine and restructure them. Finally, on a more practical level, pursuing these objectives also means sacrificing some degree of teaching efficiency, at least in the short term- a consequence often not tolerated in an outcome-focused education context (Bransford et al., 2005).

4.4.1 FATE Key Functions

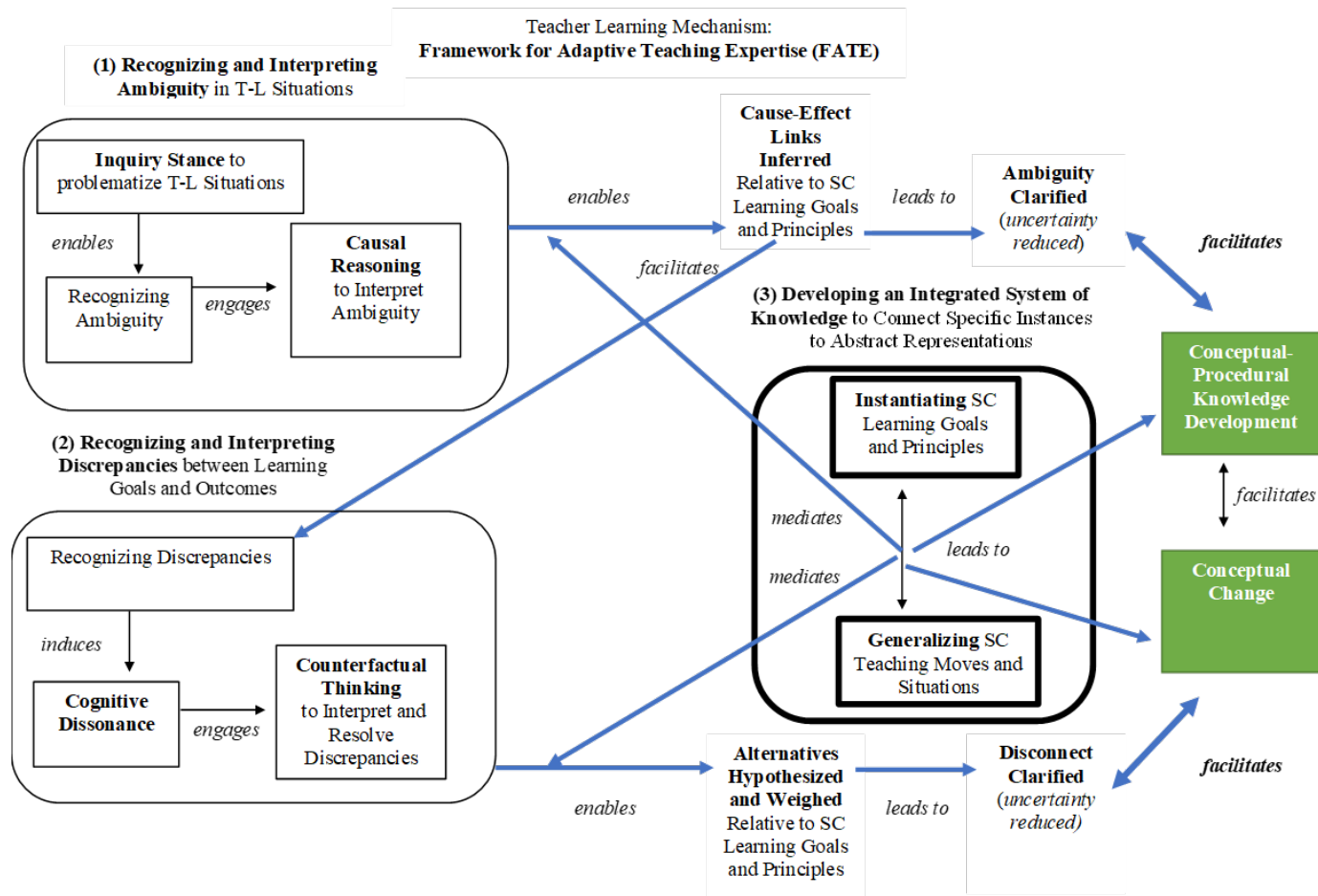


Figure 3 Framework for Adaptive Teaching Expertise (FATE)

Recognizing and Interpreting Ambiguity (see Fig 2, upper left)

1. Adaptive Teaching Expertise (ATE) requires teachers to adopt an interpretive stance to recognize the ambiguity inherent in SC instruction.
2. Recognizing T-L ambiguity engages causal reasoning processes to interpret ambiguities and reduce uncertainty.
3. The quality of teachers' cause-effect inferences is mediated by the processes of instantiating and generalizing.
4. Expert guidance is needed facilitate an interpretive stance and productive causal reasoning (i.e., linked to SC learning goals and principles)

Recognizing and Interpreting T-L Discrepancies (see Fig 2, lower left)

1. ATE requires in-the-moment problem solving to recognize discrepancies between actual and desired outcomes in T-L situations (i.e., problem recognition). Teachers' ability to recognize discrepancies is facilitated by noticing and interpreting cause-effect relationships relative to SC learning goals.
2. Recognizing a T-L discrepancy induces a state of cognitive dissonance. Once cognitive dissonance is induced, a specific kind of 'what if' reasoning-counterfactual thinking- is triggered to resolve the discrepancy.
3. The quality of teachers' hypotheses about potential alternatives is mediated by the processes of instantiating and generalizing.
4. Expert guidance is needed to guide teachers to notice evidence of an existing problem (induce productive state of dissonance) and systematically hypothesize and predict the consequences of alternative actions (engage in well-informed counterfactual thinking)

Developing an Organized Knowledge base to Link Specific Instances to Abstract Representations
(see Fig 2, middle right)

1. ATE more generally (and achieving FATE functions 1&2 more specifically) requires a highly developed base of SC conceptual and procedural knowledge (the ‘what’ and ‘how’) that links concrete ‘instances’ to larger SC learning goals and principles (the ‘why’ and ‘when’) (i.e., conceptual knowledge development).
2. ATE also requires teachers to elicit and restructure problematic or misaligned knowledge and beliefs (i.e., conceptual change).
3. Iterative processes of instantiating and generalizing are required for both conceptual knowledge development and conceptual change.
4. Expert guidance is needed to help teachers instantiate SC learning goals and principles and generalize specific teaching moves and situations.

4.4.2 FATE Potential Barriers

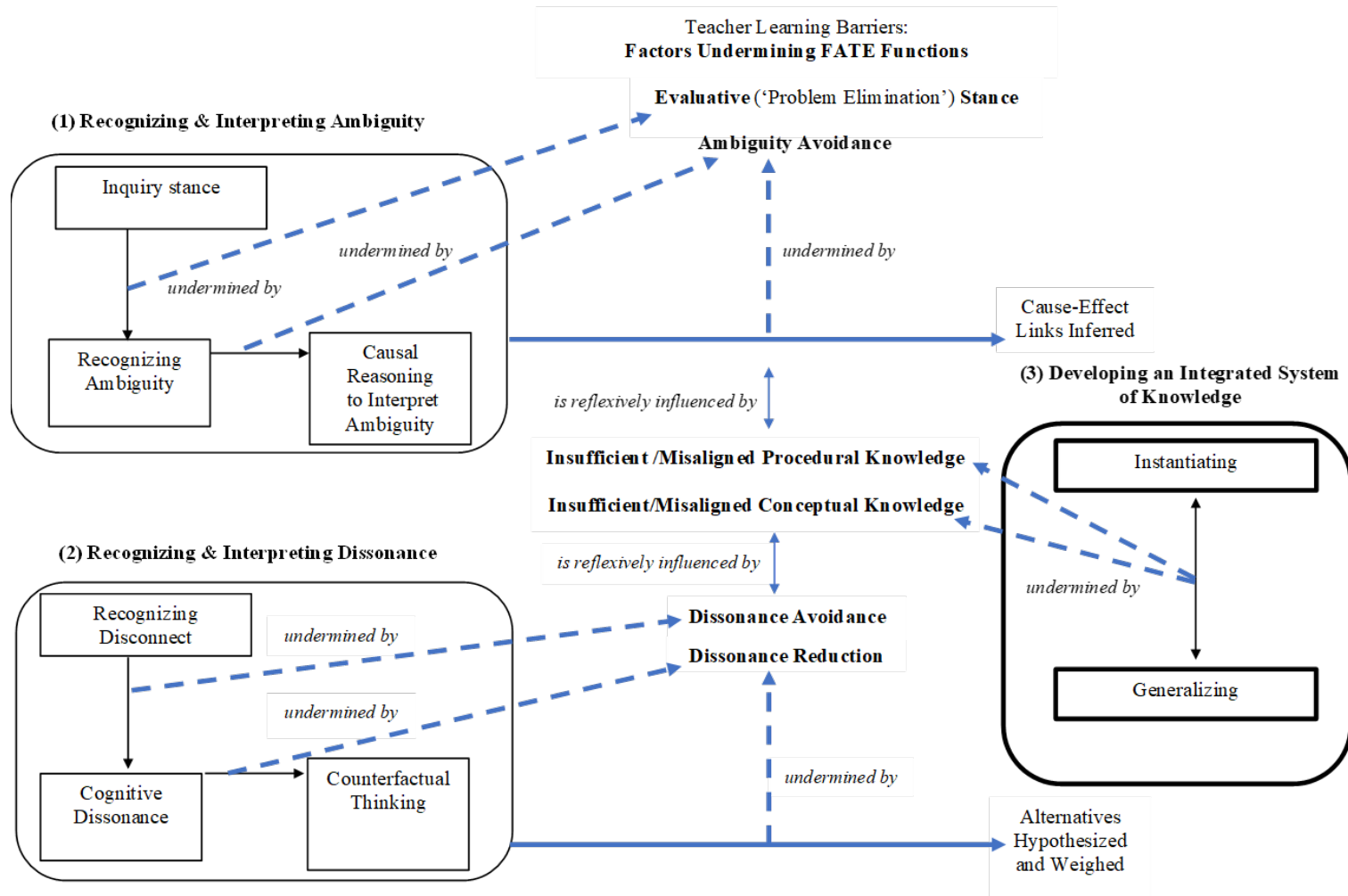


Figure 4 Teacher Learning Barriers to Advancing FATE Functions

1. *Recognizing Ambiguity* is a challenge because people naturally strive to avoid uncertainty and *Interpreting Ambiguity* can be problematic it is often automatic and implicit, leading to causal attributions that reinforce existing beliefs and assumptions.
2. *Recognizing T-L Discrepancies* is a challenge because people naturally avoid the negative affect associated with cognitive dissonance and *Interpreting T-L Discrepancies* can be problematic because people are motivated to attribute causality (problem causes) to external or erroneous factors.
3. (*Developing an Organized Knowledge base to Link Specific Instances to Abstract Representations* can be obstructed by misaligned or insufficient conceptual/procedural knowledge; Dissonance avoidance; insufficient/misaligned counterfactual thinking (latter 2 especially relevant for conceptual change).

4.5 Mental Simulations as a Teacher Learning Routine

In the previous section, we underscored, from a learning mechanisms perspective, three key functions (i.e., FATE) that the literature suggests are instrumental for developing adaptive teaching expertise and discussed the specific barriers (summarized in Figure 4) that could disrupt the effectiveness of any of these functions. Thus, having established the basic teacher learning challenge (see Fig. 1), key functions (see Fig. 2) and barriers (see Fig. 3) associated with developing adaptive SC teaching expertise, we now turn to describing mental simulations and our proposed framework for mental simulations as an applied teacher learning routine.

In what follows, we argue that a teacher learning routine based on mental simulations has high potential for advancing robust teacher change in our targeted PD context. Specifically, our mental simulation framework formalizes our identified adaptive teaching expertise functions

(FATE) in the context of an interactional routine that can inform expert-guided teacher reflection. We argue that our framework thus contributes a theoretically and empirically robust approach for defining and studying one key mechanism for developing teachers' adaptive expertise.

Prior to detailing the specifics of our proposed framework, however, we first provide some context and theoretical grounding for mental simulations as a learning construct and routine. To do this, we give a quick overview of key aspects of mental simulation theory and research that are relevant for learning and describe why mental simulation is well-suited as a teacher learning routine in an expert-guided reflection context. We highlight in particular the conditions under which mental simulation is ideal as a learning routine as suggested by cognitive psychology research.

4.5.1 Overview of Mental Simulation as a Learning Construct

The conceptual backdrop for our argument draws from cognitive research that defines mental simulation as a particular type of 'what-if' reasoning that derives from deliberate efforts to shift one's representation of an observed or possible reality (Johnson-Laird, 1983; Trickett & Trafton, 2007; Landriscina, 2015). Mental simulations can be both *retroactive*—where one seeks to re-construct a past scenario and hypothesize counterfactuals to attain desired outcomes—or *prospective*—where one seeks to construct a hypothetical scenario to attain desired outcomes based on anticipated actions and situational features (Markman & Dyczewski, 2013). Both processes involve intentionally manipulating elements of one or more existing 'mental models,' defined as an individual's mental representation or 'schema' that guides comprehension, reasoning, and prediction in a particular domain or setting (Gentner, 2002). By simulating multiple versions or interpretations of a particular mental model, one can infer a variety of cause-effect relations linked

to specific situational (or in this case, instructional) contingencies (Christensen & Schunn, 2009). As a routine that supports learning, mental simulations facilitate movement from “static to dynamic mental representations,” helping to build a more sophisticated and elaborated functional knowledge base that in turn enables more informed decision making and problem solving in practice (Landriscina et al., 2015, p. 10). Note that the term ‘mental’ emphasizes the transformation of mental structures (beliefs and understandings), but it does not imply that the routine is conducted entirely alone and in the head. Rather, mental simulations are often done collaboratively in a dyad or team, with heavy support from language and physical artifacts (Christensen & Schunn, 2009; Trickett, Trafton, Saner, & Schunn, 2007).

4.5.2 Why Mental Simulation as a Teacher Learning Routine?

Some research suggests that mental simulation plays a key role in basic scientific inquiry processes, particularly those implicated in generating hypotheses, developing novel concepts, and interpreting complex and multi-dimensional data (Landriscina et al., 2015). This research suggests that there are three specific conditions under which mental simulations are especially instrumental in learning processes: (1) Situations of informational uncertainty; (2) Situations where the goal is to move from an ‘initial’ state (undesired outcomes) to a ‘goal’ state (desired outcomes); and (3) Situations that require substantive shifts in existing knowledge representations (i.e., conceptual change or restructuring). As will be detailed in the following sections, these conditions match nicely with those involved in learning how to teach student-centered instructional approaches.

4.6 A Descriptive Model of Mental Simulations for Teacher Reflection (MSTR)

For the remainder of this section, we now turn to describing in depth what mental simulations ‘look like’ in the context of teaching and teacher learning through expert-guided reflection. This discussion is divided into three broad parts. To establish the basic descriptive MSTR model, we begin by providing an overview of the three broad components of MSTR, including brief definitions and examples of each. Next, we define and describe the quality dimensions of each MSTR component in the context of expert-guided teacher reflection. Finally, we present our illustrative empirical vignette in order to demonstrate the application of the MSTR framework in the context of a particular coach-teacher reflection ‘case.’ As such, this final section will provide the finest-grain level of detail and description of the nuances of each MSTR component, highlighting the complexities of facilitating mental simulations as a teacher learning routine in practice.

4.6.1 Basic Components of MSTR

The basic descriptive MSTR model includes three components: (1) Establish Ambiguity; (2) Propose Alternatives; and (3) Weigh Alternatives. Definitions for each of these components, as well as brief examples illustrating each component across two instructional content areas (ELA and math) are provided in Table 25 (below). As is highlighted in Table 25, we also describe how each of these components are relevant both in the context of “anticipatory” (e.g., prior to enacting a lesson) or “diagnostic” (e.g., subsequent to enacting a lesson) types of mental simulation discussions (also referred to respectively as ‘prospective’ and ‘retrospective’ mental simulations, see Ifenthaler & Landriscini et al., 2014). In both cases, the goal is to establish a shared

understanding of the pedagogical challenge or task at hand that can be facilitated or addressed with new ideas for specific teacher moves or alternative actions. In the text below, we provide a brief overview of each of these components in turn as a supplement to the information summarized in Table 25.

4.6.1.1 MSTR Component 1: Establish Ambiguity

Table 25 Mental simulation component definitions and varying character across anticipatory (before teaching) and diagnostic (after teaching) reflective dialogues between Expert (E) and Teacher (T) with examples from ELA and Math.

Mental Simulation Component	Anticipatory Mental Simulation	Diagnostic Mental Simulation
<p>(1) Establish Ambiguity</p> <p>E & T iteratively discuss and refine shared understanding of the problem space in recognition of uncertainty about the effects of teaching decisions. Situates the context for the simulation.</p>	<p>Decisions related to <i>upcoming lessons</i></p> <p><i>Examples</i></p> <p>ELA 1. How and when to select and discuss vocabulary in a text discussion</p> <p>ELA 2. How to address student misconceptions about a text during discussion</p> <p>Math 1. How to redirect students if they misinterpret what the problem is asking</p> <p>Math 2. How to pose questions that elicit student thinking</p>	<p>Decisions related to <i>the enacted lesson</i></p>
<p>(2) Propose Alternative(s)</p> <p>E & T propose teaching moves to raise for discussion as potential alternatives for addressing the ambiguity.</p>	<p><i>Potential</i> moves the teacher can use in <i>upcoming</i> lesson</p> <p><i>Examples</i></p> <p>ELA 1. Define a difficult term when it comes up OR Assume children will know this term</p> <p>ELA 2. Press student to explain their reasoning OR Ask students whether they agree with a student’s contribution and why.</p> <p>Math 1. Ask students what question are they solving OR Read question aloud and mark question parts</p> <p>Math 2. Pose a question that hints at the first solution step OR Pose a question that links problem to mathematical concept</p>	<p><i>Alternative</i> moves the teacher could have used in the <i>enacted</i> lesson</p>
<p>(3) Weigh Alternative(s)</p> <p>E & T iteratively make inferences about the potential influence of proposed alternatives. The affordances of different alternatives are weighed relative to pedagogical goals and in light of pedagogical principles.</p>	<p>Reasoning about how alternative could influence the quality of students’ learning in light of <i>anticipated</i> student responses</p> <p><i>Examples</i></p> <p>ELA. Reason about likelihood that students will know the specific term, so comprehension is not jeopardized.</p> <p>Math. Reason about whether the move gives away the answer to the question or task.</p>	<p>Reasoning about how alternative could influence the quality of students’ learning in light of <i>observed</i> student responses</p> <p><i>Examples</i></p> <p>ELA. Consider how the moves would have enabled students themselves to identify and address misconceptions.</p> <p>Math. Reason through how student thinking about the conceptual learning goals would have been elevated or declined with each teacher question.</p>

The first component, ‘Establish Ambiguity’, situates the context for the ensuing simulation discussion (see Table 25 for definition). As is also highlighted in Table 25, an ambiguity can emerge in different forms depending on the particulars—i.e., the specific challenges, needs, and conditions—brought forth by different lesson situations and contexts. As illustrated in the first row of Table 25, an ambiguity could, for example, have a broader focus on the inherent uncertainty involved with student-centered instruction more generally (i.e., that adaptive teaching by nature carries some level of unpredictability). This type of ambiguity connects to the larger principle of SC teaching as an approach that is not well suited to rigidly fixed or routinized ways of thinking about lesson planning and facilitation (i.e., ‘problematizing’ teaching-learning situations). Alternatively, an ambiguity could be more specifically focused on recognizing and interpreting a particular problem (e.g., how an unanticipated student misconception in a prior lesson could have been better handled).

4.6.1.2 MSTR Component 2: Propose Alternatives

The second component, ‘Propose Alternatives’, refers to the specification of potential options for teaching moves that could be used to address an established ambiguity (see Table 25, row 2 for definition and examples). As shown in Table 25, proposed alternatives can draw on a wide variety of possibilities that range in terms of specificity (e.g., question ‘types’ vs. specific phrasings) and temporality (i.e., planning moves for an upcoming lesson or hypothesizing alternatives based past events). As we will discuss in the next section, specificity is an especially important dimension of proposing alternatives in terms of the overall quality of a mental simulation routine.

4.6.1.3 MSTR Component 3: Weigh Alternatives

For the final component, ‘Weigh Alternatives’, the expert and teacher draw on their previous interpretations of the problem space (i.e., an established ambiguity) to systematically consider the relative merits of the proposed options for alternative moves (see Table 25, row 3 for definitions and examples). The goal for this component is for both actors (expert and teacher) to reach some shared conclusions about: (1) Which alternatives are more or less viable or valuable in a particular lesson context; (2) Reasons why (or for non-selected alternatives, why not) selected alternatives are useful for advancing student learning goals; and (3) How selected alternatives will be specifically enacted and utilized in subsequent lesson (s). As will be elaborated in subsequent sections, the function of this component centers on engaging teachers’ critical thinking and reasoning about their practice, and perhaps most critically, enabling them to generate well-informed hypotheses about the likely impact (s) of proposed moves on students’ thinking and learning trajectories and how they can be effectively leveraged in practice.

4.6.2 Qualities of MSTR Components that Contribute to Adaptive Expertise

Having established the basic components of MSTR, we now turn to a discussion of how each component advances adaptive teaching expertise in a mental simulation routine. Specifically, we define and provide in-depth description of the quality dimensions of each MSTR component with brief examples (see Table 26) along with a quick overview of each in the text below. To build our argument for how these dimensions are integral to an effective MSTR teacher learning routine, we also explain the conceptual basis for how each collectively advances our key FATE functions described in the previous section. Specifically, we make explicit how each MSTR quality

dimension is justified in terms of the learning theory and research underlying FATE (see Figure 5 for an illustration of these connections).

To preface this discussion, it's important to note that, though not the primary focus of this paper, our conceptualization of MSTR in this context (i.e., expert-guided teacher reflection) is premised on the assumption that high quality mental simulations are inherently co-constructed and situated in nature. That is, from a socio-cultural learning perspective, the intellectual 'work' for each MSTR component is grounded in collective meaning-making processes that should be mutually shared and negotiated by expert and teacher alike as opposed to, e.g., a 'correct' interpretation being unilaterally determined and communicated by the expert (i.e., a strongly directive or feedback-oriented approach to teacher reflection). Thus, though our framework has a strong 'cognitive' focus on individual-level teacher learning and conceptual change, we stress the fundamentally social and interactive nature of these processes. As will be illustrated in our final 'empirical exemplar and vignette' section, we highlight in particular the critical role of a skilled expert for maintaining a delicate balance between eliciting and scaffolding teachers' thinking in a high-quality MSTR routine.

4.6.2.1 MSTR Component 1: Establish Ambiguity

We specify two key quality dimensions, *content* and *framing*, for our first MSTR component, 'Establish Ambiguity'. As can be seen in the definitions provided in the first row of Table 26, 'content' and 'framing' are respectively closely linked to the processes of teacher 'noticing' (or 'selective attention') and reasoning (or 'interpretation') as described in the teacher education and professional development literature (see, e.g., Sherin & van Es, 2009; Walsh et al., 2020). In particular, the content dimension refers to the topic of a teacher's reflection or the specific instructional phenomenon that are salient and available to their conscious awareness. Framing, on

the other hand, refers to how a teacher interprets a specific classroom phenomenon or moment in a lesson relative to a more abstract pedagogical concept or category.

As shown in Figure 5, the content and framing dimensions of Establishing Ambiguity are particularly relevant for advancing the FATE functions, Recognizing and Interpreting Ambiguities and Recognizing and Interpreting Discrepancies. Specifically, the content dimension plays a critical role for productively *recognizing* ambiguities (FATE function 1) and/or discrepancies (FATE function 2) in teaching-learning situations (see blue text in Figure 5). In other words, it comprises the ‘what’ that identifies the motivating focus of the MS discussion (i.e., the targeted pedagogical situation or problem), which in turn lays the foundation for the ensuing mental simulation processes (i.e., causal/counterfactual reasoning, generalizing and instantiating). In the context of the first FATE function, this focus is aimed more broadly at shifting teachers’ instructional ‘vision’ to recognize teaching-learning situations as inherently ambiguous (subject to a multitude of interpretations) and malleable (contingent upon causal inputs- T moves and lesson conditions). In the context of the second FATE function, this focus is more narrowly on developing teachers’ capacity to identify when a discrepancy exists between learning goals and outcomes (planned or observed). In both cases, the extent to which MSTR supports teacher learning hinges on the extent to which the *content* of established ambiguities and/or discrepancies are identified in relational terms (i.e., instructional triangle) and SC learning goals and principles (e.g., developing student thinking).

The framing dimension of Establishing Ambiguity, on the other hand, is more keyed to the causal and counterfactual reasoning processes involved in *interpreting* ambiguities (FATE function 1) and/or discrepancies (FATE function 2) (see Figure 5 blue text). In particular, framing in this context emphasizes the importance of interpreting a particular T-L situation or discrepancy

as an ‘instance’ of a larger pedagogical issue aligned with student-centered learning goals and principles. As is shown in Figure 5, our conceptualization of framing quality applies to both processes of interpreting ambiguity (FATE function 1) and interpreting discrepancies (FATE function 2).

In professional noticing and vision research, this quality is typically described as a teacher’s capacity to interpret classroom ‘noticings’ not as discrete, disconnected events but as particular instances of larger classes or profiles of teaching-learning phenomenon (see., e.g., van Es & Sherin, 2008). Our definition of framing builds on this concept and extends it to emphasize two ways in which framing can be problematic in this context. The first is when teachers apply a misaligned or detrimental ‘lens’ that undermines instructional principles or goals (i.e., problematic generalization); the second is when teachers fail to see the larger pedagogical meanings or implications of their observations (i.e., no generalization). In our framework, both interpreting ambiguities and interpreting discrepancies are subject to these problematic framing processes (see examples in Table 26, row 1).

Table 26 Mental simulation quality dimensions for each component, with examples showing an example meeting the quality goal for a specific situation along with common examples that do not meet the goal.

Mental Simulation Components	Quality Dimensions	Examples of High and Low Quality Components
Establish Ambiguity	<p><i>Content:</i> Ambiguity ‘topic’ rooted in cause-effect targeted domain for expert practice Ex. “Dialogic teaching”:</p> <ul style="list-style-type: none"> • Conceptual learning • Student thinking • Dialogic principles <p><i>Framing:</i> Specific moment in a lesson or lesson plan is generalized to a pedagogical issue relevant across lesson contexts (i.e., includes generalized terms that could apply beyond lesson-specific goals and instantiations of pedagogical moves)</p>	<p><i>Specific pedagogical situation</i> Student misconceptions go unaddressed and unchallenged...</p> <p><i>High ...</i> is problematized in terms of holding students accountable to accurate and rigorous thinking</p> <p><i>Common iterations that diverge from this goal:</i> <i>Low1.</i> ...is problematized in terms of seeking only ‘correct’ answers from students <i>Low2.</i> ...is discussed only in terms of problem specifics</p>
Propose Alternative(s)	<p><i>Specificity:</i> Alternatives are articulated in detailed and specific terms (e.g., rehearsing the specific phrasing of teacher questions rather than just iterating general types of questions)</p> <p><i>Varied representation:</i> Multiple alternatives (2–3) are presented or an alternative is articulated/ explored in varied terms (e.g., multiple ways to phrase a particular question, or connecting an alternative to varying contingencies)</p>	<p><i>Alternatives to address situation</i> In response to student misconceptions, teacher proposes...</p> <p><i>gh:</i> ...multiple specific talk moves to address student misconception (e.g., “where’s your evidence for that claim?” or “what makes you think that?”)</p> <p><i>Common iterations that diverge from this goal:</i> <i>Low1</i> ...general question ‘types’ but specific phrasings are not elaborated (e.g., “I could have done pressing for accuracy” or pressing for reasoning...) <i>Low2</i> ...only 1 specific alternative is raised</p>
Weigh Alternative(s)	<p><i>Content:</i> Reasons offered for or against different alternatives are rooted in targeted domain for expert practice: Ex. “Dialogic teaching”:</p> <ul style="list-style-type: none"> • Conceptual learning • Student thinking • Dialogic principles <p><i>Framing:</i> Process of reasoning through alternatives includes both <i>instantiating</i> (connecting general goal or principle to specific teacher move) and <i>generalizing</i> (connecting specific teacher moves to general goal or principle)</p>	<p><i>Reasoning about different alternatives</i> Relative merits of specific proposed teacher questions in response to student misconceptions are discussed...</p> <p><i>gh:</i> ...relative to conceptual learning goals (e.g., addressing students’ misconceptions) in connection to a larger (abstract) pedagogical principle (e.g., supporting students to have responsibility for accurate knowledge)</p> <p><i>Common iterations that diverge from this goal:</i></p>

		<p><i>Low1</i> ... Not linked to conceptual learning goals or larger dialogic principles at all OR not linked to the particular teacher questions or specific student thinking</p> <p><i>Low2</i> ... Linked to procedural learning goals (e.g., selecting or offering literally 'correct' answers)</p>
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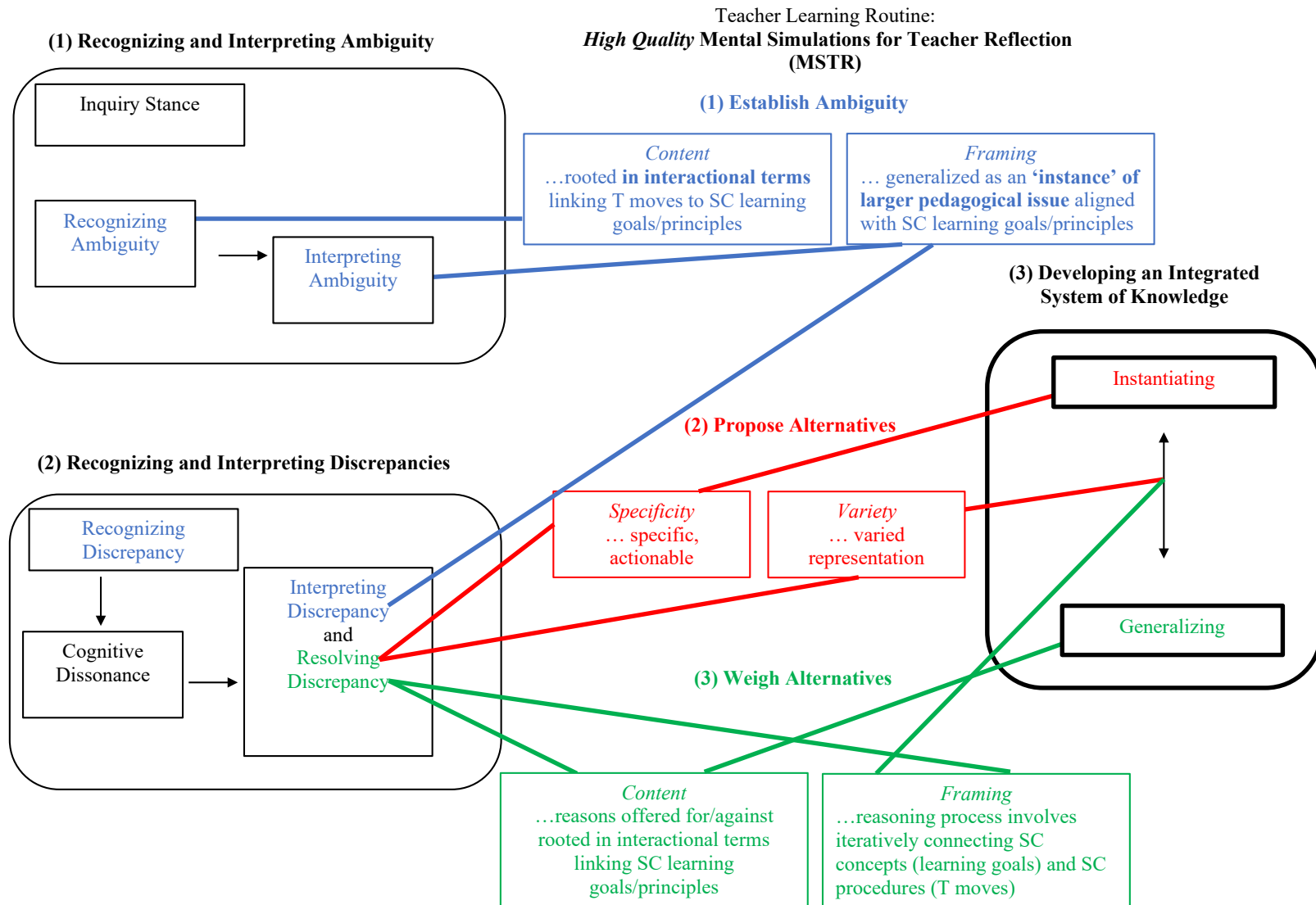


Figure 5 MSTR Components and Quality Dimensions to Facilitate FATE Functions

4.6.2.2 MSTR Component 2: Propose Alternatives

As highlighted in Table 26, we call out two quality dimensions of the second component, ‘Propose Alternatives’, relevant for developing adaptive expertise: The *specificity* and *variety* of the alternatives presented. Specificity in this context refers to the relative vagueness or concreteness of proposed teacher moves (e.g., nonspecific suggestions for question ‘types’ vs. specific and actionable question ‘phrasings’). Regarding the variety of proposed alternatives, we emphasize here the importance of *varied representation* where any particular pedagogical situation or problem is flexibly discussed relative to multiple alternatives or where one alternative is discussed in a variety of terms linked to different lesson contingencies or conditions (see Table 26).

As shown in Figure 5, this component of MSTR is especially linked to the ‘instantiating and generalizing’ processes described in FATE function 3 and the ‘resolving discrepancies’ phase of counterfactual thinking in FATE function 2. As illustrated by the red lines and text in Figure 5, we emphasize that hypothesized (or ‘proposed’) alternatives are *specific* enough to concretely guide teachers’ and decisions in future lessons. This dimension is especially relevant for ‘instantiating’ (FATE function 3) in that SC learning goals and principles can only be efficiently realized when teachers have strong practical knowledge - i.e., of specific and actionable (as opposed to general or vague) potential moves and procedures- that can be readily deployed in practice. More specifically for resolving discrepancies (FATE function 2), specificity is important because well-informed inferences about how to address a particular problem are rooted in counterfactual thinking that simulates the impacts of concrete, practical actions. Absent high levels of specificity, hypothesized solutions would carry a greater degree of ambiguity or uncertainty that would in turn be less effective for supporting efficient problem-solving in practice.

The second quality dimension of Proposed Alternatives, *varied representation*, on the other hand is more specifically linked to the reflexive interaction between instantiating and generalizing (see Figure 5). Specifically, having a variety of proposed alternatives (or having any one proposed alternative articulated in a variety of ways), increases teachers' knowledge of a repertoire of instructional moves connected to particular SC learning goals and principles (i.e., 'generalizing') that they can flexibly draw upon (i.e., 'instantiating') to adapt to varying lesson conditions or circumstances (i.e., any one move does not become rigidly linked to any one learning goal or situation and vice-versa). Similarly, as applied to the case of resolving discrepancies (FATE function 2), increasing the variety of proposed alternatives means increasing the 'arsenal' of potential moves a teacher can 'try out' to address a particular kind of pedagogical problem or challenge across lessons.

4.6.2.3 MSTR Component 3: Weigh Alternatives

For the final MSTR component, 'Weigh Alternatives,' we again invoke the concepts of *content* and *framing* as key dimensions for effectively analyzing and weighing proposed alternatives. In parallel to the first component (Establish Ambiguity), the content dimension here refers to the 'topic' (or the 'what') that is the focus of the simulation discussion. More specifically for this context (i.e., the 'weighing' component of MSTR), content quality refers to the extent to which proposed alternatives to address an established ambiguity are articulated in connection to pedagogically coherent reasons (i.e., aligned with SC learning goals and principles) (see last row of Table 26).

Conversely, though conceptually similar to the 'framing' dimension described for the first MSTR component, *framing* in this context connotes a somewhat different meaning. Specifically, whereas framing in the context of Establishing Ambiguity has a more one-directional focus on

generalizing in pedagogical reasoning (i.e., that ‘high quality’ ambiguities are by nature non-specific), framing in the context of Weighing Alternatives is bi-directional (or more precisely, cyclical) in nature. In particular, as outlined in Table 26, we emphasize the importance of a ‘back and forth’ movement in the weighing process that strikes a balance between articulating the concrete ‘particulars’ (or pedagogical moves) in the context of discussing abstract conceptual learning goals or principles (i.e., *instantiating*) and, conversely, making explicit the conceptual underpinnings that substantiate the purpose of particular moves in the context of discussing potential alternatives (i.e., *generalizing*).

Thus, the *content* and *framing* dimensions of Weighing Alternatives are most closely linked to Developing an Integrated Knowledge Base (FATE function 3) as well as resolving discrepancies through counterfactual thinking (FATE function 2). As shown in the green text of Figure 5, the content dimension of Weighing Alternatives is particularly relevant for supporting the *generalizing* function of FATE, emphasizing that inferences made about the potential impact(s) and value of available alternatives are accompanied by reasons that explicitly connect up to larger SC learning goals and principles. In other words, the content dimension of Weighing Alternatives facilitates teachers to see the ‘bigger picture’ within which they make smaller, minute-to-minute instructional choices. In terms of resolving discrepancies (FATE function 2), this dimension is more specifically related to the quality of the reasons behind the hypothesized cause-effect links that bind proposed actions to desired outcomes. We emphasize here the importance of making connections between any particular T-L discrepancy (or problem ‘instance’) to a larger ‘type’ or ‘class’ of related pedagogical issues that are significant for advancing SC learning goals and principles, and that the justifications for or against a particular move be assessed in accordance with those goals and

principles. In theory, this process would then in turn support teachers to make more well-informed inferences about the best course (s) of action if and when a similar situation arises in future lessons.

In terms of *framing*, the green text in Figure 5 indicates that this dimension is particularly relevant for facilitating productive instantiating and generalizing - i.e., the process of iteratively linking specific T-L ‘instances’ to larger concepts and meanings (FATE function 3). As such, framing in this context specifically applies to the quality of the reasoning *process* that drives instantiating and generalizing (in contrast to the content dimension, which relates to the *topic* or content of the reasons offered). As shown in Figure 5, we especially emphasize framing that consistently interprets more macro-level pedagogical concepts (i.e., SC learning goals and principles) in terms of their practical analogues and more micro-level pedagogical procedures (SC teacher moves and routines) in terms of their larger purpose or aim. By continually and iteratively making these links visible and subject to inquiry, the framing dimension of Weighing Alternatives enables a stronger and more organized knowledge base integrating SC conceptual and procedural knowledge (FATE function 3). In the context of resolving discrepancies (FATE function 2), framing thus supports teachers to build their problem-solving skills by making explicit whether and to what extent their existing ideas are linked to misaligned or problematic beliefs and assumptions (which in turn supports conceptual change).

In summary, the content dimension for Weighing Alternatives supports generalizing (FATE function 3) and resolving discrepancies (FATE function 2) when the reasons marshaled to assess and justify selected alternatives are consistently keyed to larger SC learning goals and principles. The framing dimension in turn supports knowledge development and conceptual change by iteratively building links between SC learning goals and principles and procedures (i.e., instantiating and generalizing).

4.6.3 Illustrative Vignette of MSTR in High Quality Instructional Coaching

For the final section, we describe and analyze in greater depth the processes and subcomponents involved for each MSTR component using an empirical exemplar (vignette). The aim of this discussion is to illustrate and unpack the specific subcomponents that come together in a well-executed MSTR routine. We begin with a brief overview of the PD context in which the vignette is situated. We then present excerpts from the vignette narrative, divided into three sections that correspond with each MSTR component. A table for each component provides a fine-grained description that delineates the subcomponents necessary for each to function as part of the larger mental simulation process. Each of these subcomponents is paired with a contextualized narrative summary of the coach's goals and moves linked to the vignette excerpts. Our primary goal in this section is to provide an in-depth exemplar to clearly illustrate the empirical application of MSTR. However, we also hope that features of this discussion, particularly the table descriptions and examples, can serve as a model to inform the practical work of and coaches and facilitators in similar PD contexts.

4.6.3.1 Vignette Context

The vignette is drawn from a coach-teacher reflective discussion around video of the teacher's prior classroom lesson as a part of a remote coaching intervention aimed at implementing dialogic (student-centered) text discussions in 4th and 5th grade teachers' reading comprehension lessons. Specifically, teachers engaged in multiple cycles of lesson planning (pre-lesson conference), implementing and videoing planned lessons, asynchronous (online) written reflections, and finally, synchronous reflective dialogues with the coach (post-lesson conference). For the online written reflection, the coach would select and post focal clips from the teacher's

videoed text discussion (2-3 minutes long each) along with a reflective prompt for the teacher to consider and respond to. These written reflections were then used as a basis for the ensuing post-lesson conference, where the coach and teacher jointly watched and discussed each clip remotely at their own computers (see Matsumura et al., 2019).

In the following vignette, we present excerpts from a post-lesson conference in which the coach (C) and teacher (T) synchronously watch and discuss a video clip from the teacher's previous lesson to: (1) Unpack the teaching and learning dynamics captured in the selected video clip; and (2) Generate evidence-based hypotheses about potential alternative moves to better support dialogic text discussion goals. In the video clip, the teacher had posed an open-ended question ("What's going on here?") to students during a discussion of the novel "A Long Walk to Water" by Linda Sue Park. In the preceding portion of the text, multiple pivotal events had been discussed, including a predicament in which one of the main characters (Nya) and her family must decide between two potentially perilous options in an effort to save the life of her sister (Akeer). In response students had offered an array of ideas beyond the scope of this specific dilemma that were subsequently overlooked by the teacher, who had wanted to hone students' focus more narrowly on Nya's situation. In some of these student responses, there was also evidence of potentially key misconceptions related to larger text themes and events, including apparent confusion related to multiple storylines that centered on conflict between various ethnic groups and governing factions in South Sudan.

For the online written reflection prior to the post-lesson conference, the coach had asked the teacher to consider how dialogic talk moves (e.g., pressing for reasoning, inviting students to link ideas) may have been used to more productively respond to students' ideas and address potential misconceptions. As part of her reflective prompt, the coach had also described some of

her own observations, including offering some initial inferences about the teachers’ goals and decision-making processes based on what happened in the video clip. These observations and inferences, which the coach reiterates at the beginning of the post-lesson conference prior to re-watching the video with the teacher (see Excerpt 1 below), exemplify the processes and aims associated with the first MSTR component, Establish Ambiguity.

4.6.3.2 MSTR Component 1: Establish Ambiguity

Topic: How to expand on student ideas and address potential misconceptions without constraining their thinking?

Goal: Frame specific T-L interactions in terms of a more abstract pedagogical principle or issue linked to SC instructional goals.

Table 27 Definitions and Examples of the Sub-components for ‘ Establish Ambiguity’

MSTR Component 1: Establish Ambiguity	
Sub-component	Example
<p>(1) Describe events Definition: Focused description of event in terms of instructional model and learning goals</p>	<p><i>Expert coach (C) draws attention to the variety of student responses (and potential misconceptions) elicited by the teachers’ (T) open-ended question</i></p>
<p>(2) Interpret events Definition: Interpretation of events is constructed based on inferred link between teaching move (s) and student thinking or other important situational features</p>	<p><i>C makes inferences about the T’s pedagogical choices and decision making process relative to her goals (i.e., wanting to not ‘rescue’ students)</i></p>
<p>(3) Name ambiguity Definition: Ambiguity or problem statements are iteratively put forth and refined based on prior and revised interpretations of the problem space</p>	<p><i>C voices one perspective of the pedagogical issue or ambiguity based on initial interpretation of event(s) (i.e., ‘under-facilitation) as a basis for further discussion and refinement</i></p>

As outlined in Table 27, there are three sub-components involved in the process of ‘Establish Ambiguity’: *Describe events, interpret events, and name ambiguity*. The purpose of the first sub-component, ‘describe events’ is to establish a shared set of ‘facts’ to serve as a basis for further reflection and discussion. For the second sub-component, ‘interpret events’, the goal is to cultivate and inquiry or interpretive stance for reflection by offering an initial interpretation of video evidence through the lens of cause and effect. The goal here is to also establish a broader reflection ‘norm’ that encourages the teacher to inquire and learn from his or her teaching interactions rather than pass judgement. Finally, the third sub-component, ‘name ambiguity’, offers an initial statement or perspective of the issue at hand for further discussion and iterative refinement.

Table 28 (below) illustrates how each of these subcomponents are facilitated by the coach to collectively establish a productive ambiguity (or ‘problem’) space for subsequent hypothesizing and simulating of potential alternatives:

Table 28 Dialogue Excerpt

<i>Turn</i>	<i>Speaker</i>	
1	C:	This is where you had asked, "What's going on here?" So your students are offering a number of ideas around the decision that Nya's family has to make regarding Akeer's illness. And some of these contributions are claims made without evidence from the text, and some of them might not be totally accurate...So they're saying things like, "They might get hurt on the way," but they don't really explain why. Or if they stay at the camp where the uncle is chief they might get attacked, but they don't really explain what the basis of that is.
2	C:	[In response to students], you revoice one contribution and add some information to another... but [at this point] you're not really using any talk moves here. So there seems to be evidence that you're right at the point in your talk move integration where you know what you don't want to do. You don't want to step in and rescue your students.
3	T:	Right.
4	C:	You're very clear about that, but you're still working to use your focal talk moves at the key moments. This leads me to think at this juncture you're listening more than responding at times. So that's a point on the integration continuum. You're

		listening and you know what you don't want to do, but you just haven't figured out a way to really apply those talk moves.
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Here, the coach initiates the discussion by describing the T-L situation using specific video evidence and verbatim statements rather than vague descriptions or recollections (T1: *This is where you had asked, "What's going on here?" So your students are offering a number of ideas...*). The coach then offers her ‘take’ on the situation based on established evidence, putting forth an initial interpretation of the T-L issue using non-evaluative language (T2: *So there seems to be evidence...you don't want to step in and rescue your students.*) Importantly, the coach frames her interpretation in terms of connecting to the teacher’s goals and in-the-moment thinking - abstracting from the specifics of the situation (i.e., teacher’s non-responsiveness to students) to what they represent as a class of moves that serve a purpose (maintaining cognitive demand by not ‘rescuing’ students). Finally, the coach introduces an initial ambiguity ‘statement’ that locates the teacher on a larger continuum of learning- i.e., where she is listening more to students but struggling to respond with talk moves to grow their thinking (T4: *This leads me to think at this juncture you're listening more than responding at times...*). It’s worth noting that at this juncture, the ‘name ambiguity’ sub-component is not meant to offer a fully-fleshed ‘diagnosis’ and/or ‘remedy’ to the problem at hand- rather, the goal is to offer a first attempt to problematize situation to set up for the next stage of the simulation.

4.6.3.3 MSTR Component 2: Propose Alternatives

Topic: Which talk moves might be useful to facilitate more rigorous and accurate student discussion?

Goal: Propose specific and actionable teacher moves in connection to stated ambiguities

Table 29 Definitions and Examples of the Sub-components for ‘Propose Alternatives’

MSTR Component 2: Propose Alternatives	
Sub-component	Example
<p>(1) Brainstorm alternatives Definition: Teachers’ thoughts about alternatives to achieve learning goals are elicited</p>	<p><i>C invites T thinking, frames question in “if...then” terms that link to goals for student thinking (i.e., ‘given X set of circumstances, what are some options?’?)</i></p>
<p>(2) Select alternatives Definition: Alternative(s) are selected for further discussion</p>	<p><i>C marks and reiterates T ideas for alternative moves to explore in depth, emphasizing teacher authorship</i></p>

Table 30 Dialogue Excerpt

<i>Turn</i>	<i>Speaker</i>	
1	C:	So we're going to use this [video segment] as a way to think back and consider what talk moves might you have used and how might they have changed the trajectory of the discussion. You were thinking about this and had some ideas: "I could have been pressing for accuracy a bit more in some areas. I could also, when Rodrigo gave his two options, could have done a keeping everyone together, asking which option they thought was better, and to explain why using evidence from the text. So perhaps with some of the students' answers I could have been pressing for reasoning, although I feel that this might just serve to have them for their possibly incorrect answers." So you were thinking this might have worked out or they might have just dug in more deeply.
2	C:	So I thought, well, let's kind of play this out. Let's try a couple of these options and think them through watching this video. So for pressing for accuracy, you'd be asking things like, "Where can we find that? What's the basis for that conclusion?"
3	C:	You talk about, when Rodrigo gave his two options, keeping everyone together, asking which option they thought was better and explain why... "Rodrigo has put two things on the table. Do these make sense to you and what's your evidence? Let's spend some time considering these."
4	C:	Then your last was pressing for reasoning, [asking students], "Why do you think that?" , and then hoping that they would dig in more deeply in order to tell why they think that.

Here, the coach elicits and revoices teachers' initial thinking about potential moves using 'if...then' terms anchored in shared language (i.e., dialogic talk moves) about specific teacher moves and student learning goals (T1: [quoting the teacher]... "*I could have been pressing for accuracy a bit more in some areas.*"... *So you were thinking this might have worked out or they might have just dug in more deeply.*) This excerpt also highlights how the coach uses language that recognizes the teacher's contribution and ownership of ideas for practice. Specifically, the coach raises up teacher suggestion (s) as legitimate and worthy of discussion- e.g., Inviting students to link ideas (T3: [quoting the teacher]: ..."*Rodrigo has put two things on the table...Let's spend some time considering these*") and pressing for student reasoning (T4: [quoting the teacher]..."*Why do you think that?*"...*and then [you were] hoping that they would dig in more deeply...*). Importantly, the coach raises up these ideas even though, as will be illustrated in the

following section, the teachers' initial suggested alternatives (that focused on Rodrigo's comments) are not ideal relative to the teachers' learning goals for students and the nature of the other student contributions present. However, raising up teacher ideas that are not viable or strongly linked to SC instructional goals (in addition to ones that are more closely aligned) provides a valuable learning opportunity in the next component of MSTR- i.e., 'Weigh Alternatives'- where the goal is to support the teacher to arrive at her own understanding of whether and why a particular alternative move is valuable (or not) in terms of students' thinking opportunities in discussion.

4.6.3.4 MSTR Component 3: Weigh Alternatives

Topic: What are the potential impacts and relative merits of proposed alternatives for advancing students' thinking in discussion?

Goal: Think counterfactually about alternatives in order to draw well-informed conclusions about the best (or better) alternative moves for achieving SC learning goals in discussion.

Table 31 Definitions and Examples of the Sub-components for ‘Weigh Alternatives’

MSTR Component 3: Weigh Alternatives	
Sub-component	Example
<p>(1) Generate inferences</p> <p>Definition: The value of different alternatives is reasoned through based on hypothesized effects on student thinking</p>	<p><i>C induces T’s counterfactual thinking to infer the plausible effects of raised alternative(s) given situation specifics. This is often done in a ‘role play’ type of format.</i></p>
<p>(2) Scaffold Meaning-making processes</p> <p>Definition: Talk moves are used to scaffold teachers’ reasoning about proposed alternatives and inferred effects on student thinking relative to student thinking goals</p>	<p><i>C uses talk moves responsively based on their ‘read’ of teachers’ current thinking/stage of development</i></p> <p><i>Example Scaffolding Moves:</i></p> <p>Challenging</p> <p>Redirect</p> <p>Modeling pedagogical reasoning</p> <p>Offering or marking alternatives</p> <p>Connecting to teacher goals</p> <p>Role playing to invite teacher perspective taking and hypothetical thinking</p>

As shown in Table 31, the goal of the first sub-component for ‘Weigh Alternatives’, ‘*generate inferences*’, is for the coach and teacher to jointly elaborate on a previously established ambiguity. To do this, the coach induces teachers’ counterfactual thinking and elicits their reasoning about selected alternatives. For sub-component 2, ‘*scaffold meaning-making processes*’, the goal is to push and explore teachers’ critical thinking by adaptively responding to and scaffolding teachers’ inputs. To do this, the coach draws on a variety of facilitation moves (see row 2 of Table 31) that provide more or less guidance depending on the teachers’ learning needs (e.g., challenging teachers’ claims or interpretations of video; modeling productive pedagogical reasoning- see Zook-Howell, Matsumura, Walsh, Correnti, & Bickel, 2020 for a longer discussion of coach facilitation moves). These are illustrated throughout the following excerpts, beginning with Excerpt 3.

Excerpt 3 (below) begins immediately after the coach and teacher synchronously re-watched the video clip, where the coach had raised up one of the alternatives suggested by the teacher (inviting students to link to Rodrigo’s comments about Nya’s dilemma) to weigh relative to evidence of students’ thinking in video and her goals for rigorous and accurate student discussion:

Table 32 Dialogue Excerpt

<i>Turn</i>	<i>Speaker</i>	
1	T:	I think if I had nipped it in the bud when Rodrigo gave his two options and we had kind of focused the discussion on those two, "Okay, he gave us two options." What do you think about these two options,", or, "What would happen if they left? What do you think about these being the reasons that they're concerned?" I think it would have eliminated some of the more abstract ideas that they were all reaching for to come up with more reasons, and would have refocused them on which choice the family would most likely make. What was their thinking behind [this decision]?
2	C:	I don't know if Rodrigo is actually giving them two options to consider, because those are the two options that the family had to think about. Right? (1)
3	T:	Right. He gave the two that we were looking for. I think in asking if anybody else had anything else, they were then reaching. They were reaching for reasons that they wouldn't take the walk or reasons that they would be worried to stay home. I don't know. I feel like it went into abstract areas, that they were trying to find proof for things that there really weren't, if that makes sense.
4	C:	I do understand what you're saying. I guess the question here is: what else in the text was there for them to talk about, besides this dilemma? (2)
5	T:	Not much. (T impasse)
6	C:	But maybe there was...I'm looking at what they said in the beginning. They understand the idea that it's a long walk. They understand that there's medicine if she gets there... Did they mention medicine? (1)
7	T:	I don't think they did.
8	C:	So that's one thing they left out...They talk about getting there, but they don't actually mention that if she gets there she gets medicine. Like why take the long walk? So there are some things that they didn't get at that were worth exploring. (4) So I don't know that stopping at Rodrigo – I mean I know what you're saying. Like in hindsight you're thinking like, "Let's just cut off the kids that took us down that path..." (3)
9	T:	That took a left turn.
10	C:	But I'm thinking they had some important misconceptions. Like, if they stay at camp, their uncle is the chief. They might get attacked. That's a really interesting thing that student said. So that might have needed exploring. You know? I mean asking them why they thought that. That might be important. (1) (4)

In this excerpt, the teacher began by generating a well-reasoned inference about the potential impact of an alternative teacher move (T1: *"Okay, he gave us two options... What do you think about these two options?" ... I think it would have eliminated some of the more abstract ideas that thy were all reaching for to come up with...*). In response, the coach scaffolds the meaning-making process by offering a challenge to teachers' initial interpretation- i.e., that it's not really Rodrigo's idea as those are the two available options stated in text (T2: *I don't know if Rodrigo is actually giving them two options to consider...*). The teacher then offers another response that is well-reasoned (T3: *He gave the two that we were looking for...I think in asking if anyone had anything else...[students] were trying to find things that really weren't...*), but, as becomes clear later in the discussion, is based on a premise that is not supported by video evidence (i.e., that students were offering unrelated ideas that would lead the discussion into unproductive territory).

As such, the coach then uses another scaffolding move to redirect the teacher's thinking (T4: *I guess the question here is, what else in the text was there for [students] to talk about, besides this dilemma?*) In her response, the coach both acknowledges the teachers' reasoning (T4: *I do understand what you're saying...*) and encourages her to think about the situation from a different perspective- i.e., that there may be more to talk about than just Nya's two options, which represents a relatively constrained discussion space. Importantly, these aspects of the coach's response convey a reflective stance that is non-authoritative and non-evaluative in nature (i.e., 'correcting' the teacher or telling her that her thinking is flawed).

However, the teacher's next response (T5: *Not much.*) indicates an 'impasse' or initial failure to connect with the new line of inquiry put forth by the coach. The coach responds with challenge to offer alternative perspective (T6: *But maybe there was...I'm looking at what they said in the beginning. They understand the idea that it's a long walk...Did they mention medicine?*).

She continues to elaborate on this specific idea (e.g., T8: *So there are some things that they didn't get at that were worth exploring...*) and used other facilitation moves such as modeling pedagogical reasoning to call out and interpret other important evidence (T10: *But I'm thinking they had some important misconceptions. Like, that if [Nya and her family] stay at the camp, their uncle is the chief [and] they might get attacked...that might have needed exploring. You know?*) while also continuing to acknowledge the teachers' initial thinking (T8: *I mean I know what you're saying...*).

From here, the coach and teacher continue the conversation about student misconceptions, including one student contribution (that had been ignored by the teacher in the video) where the student appeared to be applying an unrelated text storyline about warfare between the Dinka and Nuer tribes in their interpretation of events surrounding another main character, Salva, who was embroiled in a conflict between governing and rebel groups. The ensuing conversation between coach and teacher is highlighted below in the final section of Excerpt 3:

Table 33 Dialogue Excerpt, cont'd

<i>Turn</i>	<i>Speaker</i>	
15	C:	So I'm going back to something that you said earlier tonight about thinking that these discussions can be really useful for noticing things about your students. That would be a really interesting thing to find out. Why does he think that?– Is he so taken by the Dinka-Nuer conflict that they are thinking that they are just constantly under siege, even though that's not what the text says at all. (5) (3)
16	T:	...That's because Salva's story revolves around the fighting.
17	C:	Right, but it's not the Dinka and Nuer fighting.
18	T:	No, I don't think they've made that distinction. My kids are inner city kids. I think for them, the idea of the Dinka and Nuer as one tribe against the other makes more sense as like one gang against another... whereas I think the rebels against the government is a much more abstract idea for them.

Here, the coach explicitly connects this specific 'instance' up to the teachers' previously stated goals for her teaching (T11: *So I'm going back to something that you said earlier... about*

[how] these discussions can be really useful for noticing things about your students) thereby framing this student's contribution not just as a misconception that needs to be addressed, but as an opportunity for the teacher to learn about her students. The teacher then generates an inference about the potential source of the misconception (T16: *...because Salva's story revolves around the fighting...*) and the discussion excerpt concludes with a rich reflection where the teacher makes links between students' thinking, text content, and students' background (T18: *No, I don't think they've made that distinction... I think the rebels against the government is a much more abstract idea for them.*).

We now turn to the final two sub-components of 'Weigh Alternatives': *relaunching* the simulation and *linking* specifics to abstract representations (see Table 34).

Table 34 Definitions and Examples of the Sub-components of ‘Weigh Alternatives’, cont’d

MSTR Component 3: Weigh Alternatives	
Sub-component	Example
<p>(3) Relaunch the simulation Definition: Subsequent to discussion and inquiry about proposed alternatives relative to lesson specifics and goals, conversation ‘resets’ to return to concrete consideration of specific (actionable) choices</p>	<p><i>C redirects discussion to re-focus on simulation of specific alternative alternatives in order to inform future action</i></p>
<p>(4) Link specifics to abstract representations Definition: Learner makes explicit connection between the specifics of the targeted pedagogical situation with larger pedagogical principles/goals (i.e., expression of ‘learning’)</p>	<p><i>T makes connections between her available choices in this particular scenario (i.e., which lines of inquiry to follow) to the larger pedagogical principle of flexibly responding to student thinking and working to maximize those opportunities (rather than privilege other procedural goals like finishing a chapter)</i></p>

‘Relaunch the simulation’⁸ is called for when there is a need to return (or ‘reset’) the to return the focus of the discussion to specific alternative moves that could be used in similar situations in future lessons. In other words, the relaunch sub-component of Weighing is relevant in situations where the joint interpretation of the ambiguity space has evolved significantly (here, from the teachers’ initial aim to refocus student discussion on Rodrigo’s comments to the exploration of other student ideas and potential misconceptions). For the final subcomponent, “linking specifics to abstract representations”, the goal is for the learner (in this case, the teacher) to explicitly make connections between selected alternative moves for a specific T-L discrepancy to larger pedagogical principles, challenges, or situations that span beyond any particular lesson

⁸ NOTE: ‘Relaunch’ in this context is distinguished from the ‘redirect’ coach scaffolding move. Here, ‘relaunch’ specifically refers to ‘resetting’ or ‘restarting’ the simulation of specific alternatives (i.e., revisiting specifics subsequent to larger sensemaking discussion)

or learning goal. Excerpt 4 illustrates how these sub-components unfolded in the remainder of the coach-teacher discussion vignette:

Table 35 Dialogue Excerpt

<i>Turn</i>	<i>Speaker</i>	
1	C:	So going back to the three ideas you had, you had pressing for accuracy, pressing for reasoning or challenging. What do you think you might find most useful in this?
2	T:	I guess the pressing for reasoning.
3	C:	Okay. So the first thing that a student says that is not really text-based is the thing about, "If they stay at camp, they might get attacked."
4	C:	So if you press for reasoning – let's just role play this out. So you press for reasoning and the student says, "Well –" Okay. What would you say? (6)
5	T:	(as teacher): What makes you think that?
6	C:	(as student): Because they are Nuer and the Dinkas might attack them.
7	T:	Okay. What evidence from the text would support that?
8	C:	Well it said in the text that the Dinka and the Nuer have been fighting for hundreds of years.
9	T:	Have we read anything in the text so far that has shown them fighting?
10	C:	There's lots of people carrying guns.
11	T:	This is true. There are people fighting and carrying guns. But which part of the – whose story –? (END OF ROLE PLAY)
12	T:	Do you think that would be a good idea to kind of delve into the two separate stories?
13	C:	Yeah, because I think that's exactly what kids would do. They would think there's a lot of war going on.
14	T:	Right, but that a lot of war is coming in Salva's story. So in Nya's story have we encountered the guns and the war?
15	C:	No, actually no. I guess you're right. That is Salva's story. So yeah, you could do that with a student and them think about the fact that in Salva's story that's happening. In Nya's story that's not happening. And that's one of the complexities in this particular kind of text, is that there are these parallel stories. There are a great deal of similarities because they both take place in Sudan. There's the ongoing issue of water. There are a number of similarities, but there are also different time periods and different story lines. It's tricky. Two totally different tribes.
16	T:	Yeah. So I have to do a better job of taking their misconceptions and figuring out why they're thinking that way, which again leads to that struggle of the lesson plan out the window and just roll with the discussion.
17	C:	But don't throw it out the window, because those original questions that you ask each time, those move the lesson along. Those are really important. You don't want to start adding or deleting your questions, because your original lesson plan is powerful.
18	T:	It all ties back to that allowing the discussion to evolve and facilitating the discussion, rather than, quote/unquote, teaching and leading a lesson.
19	C:	That's a really good way of phrasing it.
20	T:	It's a different way of looking at it. They're still learning, but they're learning via discussion. Sometimes we learn as educators, as Ts things that were unclear and we have to clear those up, and know when to let it ride, like with the lion, with Marial being left. I mean we could have delved a lot further into that, but it really wouldn't have gotten us anywhere, so knowing when to cut and say, "Okay, you guys, we'll read more about this. Let's see if it changes our thinking once we've read a little bit further."
21	C:	Right, and that made a lot of sense because you knew that they would have further evidence. So it wasn't a good use of time to spend more minutes on that, when you knew that they'd have more evidence to come, and then they could delve into it again

In this excerpt, the coach re-initiates the simulation by circling back to the concrete alternatives that could be used to achieve better outcomes in future lessons- in effect ‘resetting’ the weighing discussion digging in-depth into the lesson specifics and student thinking dynamics in the proceeding excerpt (T1: *So going back to the three ideas you had...What do you think you might find most useful in this [situation]?*). Notably, the teacher offers in response an alternative that is non-specific and unelaborated (T2: *I guess the pressing for reasoning*). Drawing once again on scaffolding moves, the coach then initiates a ‘role play’ discussion to encourage the teacher to instantiate her learning goals in concrete action- i.e., specific question phrasings rather than just general ‘types’- and to generalize by inviting the teacher’s pedagogical thinking and reasoning to weigh the proposed alternative relative to students’ thinking (T4: *...let's just role play this out. So if you press for reasoning and the student says, “Well...” Okay. What would you say?*). As illustrated in T5-T11 of the excerpt, the ensuing ‘role play’ conversation engages teachers’ thinking about the specifics of her questions and rejoinders and the impact of those moves from the perspective of how a student might infer and think about text (as modeled by the coach). Notably, this conversation leads the teacher to inquire about a facet of the text she hadn’t before considered (T11: *This is true. There are people fighting and carrying guns. But which part of the – whose story –?*) [Teacher stops role play and queries the coach]: *Do you think that would be a good idea to kind of delve into the two separate stories?*). This question in turn leads to a productive new line of inquiry that includes rich insight and observation on the part of the teacher that challenges the coach’s initial interpretation (T14: *Right, but that a lot of war is coming in Salva's story. So in Nya's story have we encountered the guns and the war?*).

The last sub-component of Weigh Alternatives, ‘linking specifics to abstract representations’, is especially highlighted in the final phase of the discussion in Table 35,

beginning with the coach's response to the teachers' challenge (T15: *No, actually no. I guess you're right. That is Salva's story...*). In particular, coach takes up the teacher's line of inquiry and connects it back up to a larger concept in the discipline- parallel storylines as a component of rich texts- that applies across lessons (T15: *...And that's one of the complexities of this particular kind of text...*) The conversation then proceeds with the teacher making a connection between this particular T-L situation- i.e., a student confusing multiple character storylines and sources of conflict- to larger pedagogical goals and issues- i.e., using student misconceptions as a tool for growing their learning (T16: *Yeah. So I have to do a better job of taking their misconceptions and figuring out why they're thinking that way...*) and flexibly adapting lesson plans in light of student's discussion trajectory T16: *...which again leads to that struggle of the lesson plan out the window and just roll with the discussion..*”).

The discussion proceeds with the coach once again leveraging scaffolding moves to take up and extend the teacher's comment, offering a slight push-back or challenge to her assertion (T17: *But don't throw [your lesson plan] out the window, because those original questions that you ask each time, those move the lesson along...*) in a way that also affirms the quality of the teacher's initial ideas (T17: *You don't want to start adding or deleting your questions, because your original lesson plan is powerful*”). This in turn prompts the teacher to refine her initial interpretation, offering a more sophisticated reframing of the issue that connects up to a larger key principle in dialogic teaching (T18: *It all ties back to that allowing the discussion to evolve and facilitating the discussion, rather than, quote/unquote, teaching and leading a lesson.*). Finally, the discussion excerpt concludes with the teacher offering a rich summative statement that links together teaching moves, SC instructional goals, text content, and student thinking in ways that are both specific and abstract (i.e., instantiating and generalizing):

T20: *It's a different way of looking at it. They're still learning, but they're learning via discussion. Sometimes we learn as educators, as Ts things that were unclear and we have to clear those up, and know when to let it ride, like with the lion, with Marial being left. I mean we could have delved a lot further into that, but it really wouldn't have gotten us anywhere, so knowing when to cut and say, "Okay, you guys, we'll read more about this. Let's see if it changes our thinking once we've read a little bit further."*

4.7 Discussion

4.7.1 Key Contributions

In this paper we proposed a Mental Simulations for Teacher Reflection (MSTR) framework as a tool to conceptualize, implement, and study one theoretically robust routine for developing adaptive teaching expertise. Integrating key cognitive and situated learning theory perspectives and research, this study contributes insight into the nature of teacher learning processes and mechanisms of change- an historically underexplored but increasingly vital area of inquiry given current student-centered instructional reforms. By specifying the conceptual and practical dimensions of one well-supported mechanism of teacher learning (i.e., developing adaptive teaching expertise through mental simulations), the present study represents an important step towards de-mystifying this 'black box' (Correnti & Rowan, 2007) of teachers' professional learning in instructional coaching. Moreover, our proposed framework is distinctive in that it is suitable for application in a variety of reflection-based professional development settings (e.g.,

personalized coaching or facilitator-led video clubs) and content areas (e.g., student-centered ELA or math instruction), heightening the potential of this work for wider research utility and impact.

In addition to being relatively flexible in nature, MSTR is also integrally tied to specific teacher learning theory and development principles. Such specificity is important in the conceptualization and design of productive teacher learning environments. When frameworks lack specificity in seeking to be broadly applicable, they provide no actionable guidance. Consider, for example, the context of teacher reflection. It is nearly ubiquitous in frameworks about professional development practice, but it often lacks conceptual clarity, which fails to be useful to design (what should teachers be reflecting upon?), or rigorous empirical investigation (what would count as not being reflective?) (Beauchamp, 2015; Lefstein, Louie, Segal, & Bechar, 2020). Our framework defines both the ‘what’ and the ‘how’ of productive teacher reflection in the context of student-centered teaching practice.

Moreover, our Framework for Adaptive Teaching Expertise (FATE) makes a contribution by identifying specific, conceptually-aligned ‘key functions’ that learning theory and research suggest are collectively essential for developing adaptive teaching expertise. Although we have focused upon a mental simulation routine as a means to facilitate these functions in professional development practice, these key functions also would apply to other types of teacher learning routines. That is, because we have specified what we argue are the essential ‘ingredients’ of a teacher learning mechanism for developing adaptive expertise, this work can be leveraged and extended to inform an array of professional development routines (e.g., teacher rehearsals (Kazemi, Gousseini, Cunard, & Turrou, 2016) and classroom video tagging and analysis tools (Walkoe, Sherin, & Elby, 2020)).

Lastly, we highlight the value of our framework for elaborating what an effective mental simulation teacher learning routine ‘looks like’ at multiple layers of context-specificity. Simulation and model-based learning represents a broad area of research (see Seel, 2017 for a review). In cognitive psychology, this research often focuses on theorizing, clarifying, and explicating the cognitive processes of mental simulation as a tool for solving specific problems or tasks (e.g., solving a particular engineering or design issue, Christensen & Schunn, 2009). By contrast, there has been considerably less focus on mental simulation as a mechanism for learning- i.e., as a means to develop the transferable knowledge and skills that comprise a particular domain of expertise- or on exploring the interactional and contextual features that functionally instantiate mental simulations in different learning settings. In teacher education, there is a small but growing area of research on the design and facilitation of simulation-based learning environments for pre-service teachers (see, e.g., Codreanu et al., 2020). The present study builds on and extends this work by offering a mental (as opposed to, e.g., virtual or computer-based) simulation framework as a learning routine for in-service teacher learning contexts. By offering both relatively abstract definitions of mental simulation components and quality dimensions (in Tables 25 and 26) as well as fine-grained, in-depth illustrations of this routine in a specific context (in the vignette narrative and Tables 27, 29, & 31), our MSTR framework offers comprehensive conceptual and empirical guidance for employing mental simulations in teacher learning settings.

4.7.2 Practical Implications

Our contributions are made in the context of field of research that has made considerable advances in identifying high-leverage professional development practices (Darling-Hammond, Hyler, & Gardner, 2017) and ‘essential features’ (Desimone, 2009). Significant progress has been

made, for example, on how to develop and sequence teacher reflection activities that support high-level discussion, analysis, and experimentation with new practices (Gaudin & Chalies, 2015). Learning sciences research has similarly furthered our understanding of what distinguishes effective from ineffective types of learning interactions and environments. In teacher learning, this shift is perhaps most emblematic in the declining popularity of sporadic, direct-instruction style workshops in favor of more authentic, apprenticeship-style programs that position teachers as capable professional thinkers and active sensemakers (Kennedy, 2019).

Despite these research literature advancements on productive professional learning environments, the quality and implementation of even well-specified and supported professional development features remains stubbornly inconsistent across program instantiations and trials. We know, for example, that video-based coaching can be highly effective for improving teaching practice and student learning outcomes (Matsumura, Correnti, Walsh, Bickel & Zook-Howell, 2019; ; Powell, Diamond, Burchinal, & Koehler, 2010; Sedova et al, 2016; and much work has developed to determine key video reflection design features associated with positive outcomes—e.g., selecting and framing video clips to highlight significant classroom interactions; establishing a shared vision and repertoire of high quality instructional practices, see van Es et al., 2014; Resnitskaya & Wilkinson, 2015). However, empirical evidence suggests that high quality, high leverage design features are necessary but insufficient for effecting robust teaching and learning outcomes (Osborne et al., 2019). In particular, research has found that a significant amount of variation in teacher learning outcomes is explained by coach assignment in some larger-scale programs (see, e.g., Downer et al., 2009) indicating that even when coaches receive similar training and supports, there is still a wide range of variability in terms of their efficacy working with teachers. This variation often remains under-examined or theorized, leaving unanswered

important questions about how and why some professional development coaches and facilitators are effective for substantively improving teaching practice and others are not (LoCasale-Crouch et al., 2016). Put another way: What is it about the interactional processes, routines, and practices of high-achieving coaches that make them so effective for teacher learning?

This issue highlights why focusing solely on professional development as just inputs and outcomes is so problematic for the field. Absent greater focus on the mechanisms that mediate professional learning activities and outcomes, the creation of robust designs for teacher learning and training programs for professional development coaches and facilitators will be significantly hampered. Further, if we conceptualize coaching and facilitation as its own kind of adaptive expertise, then improving the quality of coach and facilitator training will require going beyond building their knowledge of the ‘high-leverage’ facilitation ‘moves’ and practices associated with better teacher learning outcomes. Rather, coaches’ ability to leverage these facilitation moves effectively will likely be contingent upon having a strong conceptual knowledge of how these ‘particulars’ function relative to larger learning goals and principles. In the context of our mental simulation framework, for example, we have stressed that the various facilitation moves highlighted for each component (i.e., in the vignette), are only meaningful insofar as they work collectively to advance the specified key functions for developing adaptive expertise. A strong understanding of the conceptual links that enjoin teacher learning theory and practice—i.e., developing adaptive expertise for *teacher learning*—is therefore an essential requisite for being a highly effective and responsive facilitator of any teacher learning routine, including mental simulations.

In this sense, our goal for the present study is to not only bolster basic teacher learning theory and mechanisms of change research, but to also help inform the on-the-ground work of

professional developers and facilitators. To this end, our framework could be leveraged to help conceptualize and establish interactional routines (e.g., mental simulation) in more intentional ways- i.e., in connection to specific teacher learning aims, needs, and pedagogical situations. In a pre-lesson conference, for example, coaches might be trained to recognize when a teacher is struggling to anticipate the variety of ways her planned questions could impact student thinking in classroom discussion. Similarly, a coach could learn to identify in a post-lesson conference when a teacher has reached an impasse in trying to understand why a particular teaching-learning interaction went awry (i.e., problem ‘diagnosis’) and hypothesize ways to better support student learning goals in similar future situations (i.e., problem solving). We argue that our mental simulation framework would serve as a conceptually robust practical tool for coaches to advance teachers’ learning in cases such as these.

4.7.3 Limitations and Future Directions

Of course, there are a number of caveats to consider in the present study. We have presented a conceptual argument, grounded in qualitative data from multiple contexts, for our identified key functions and mental simulation framework. However, additional empirical work is needed to further substantiate and test these claims. It might be the case, for example, that some of our key functions or MSTR components are more critical than others for developing adaptive teaching expertise, especially as applied to other teacher reflection contexts. We developed our framework in an iterative fashion, drawing upon close collaboration with an expert coach, integration of existing literature, as well as ongoing analyses of a selection of coaching dialogues that varied in key ways including program type, content area, and demonstrated coach effectiveness. However,

other expert coaches and professional developers might have other strategies, grounded in different frameworks, that could also be successful.

We would also like to emphasize, though not the primary focus of the present study, the indispensable role of the expert facilitators' (in this case, the coach's) for preparing and facilitating a productive teacher learning context in any PD practice, including a mental simulation routine. As alluded to previously, this study is rooted in the larger theoretical assumption that teacher learning, as with all learning, is socially constructed and that new knowledge and insights ultimately arise from the dynamic meaning-making and negotiating processes that occur between coach, teacher, and context. Thus, though this study's primary aim was to identify and formalize key functions for developing adaptive expertise in expert-guided teacher reflection, future work is needed to better understand the interactional dynamics that would structure a productive MSTR teacher learning routine. This could include, for example, systematically analyzing and identifying 'profiles' of coach moves in response to particular teacher learning needs (e.g., different types of teacher 'impasses' in reflection and how they can be effectively addressed), and key social-relational dynamics and dispositions on the part of the coach, the teacher, or in combination with each other that influence the quality of the teacher learning experience.

In this sense, the high level of expertise of our collaborating expert coach, though beneficial for the purposes of this study, does however raise important questions about how effectively our mental simulation framework could be leveraged more broadly. First, what struggles will coaches and other facilitators encounter in trying to enact this routine? Second, what kinds of conceptual understandings, strategies, and supporting tools will make productive enactment of mental simulations more reliable? The goal is not to standardize a strict script, but rather to develop a better understanding of how a wider range of coaches will take up this routine. Third, what factors

that affect the quality of teacher-coach interactions will be especially important in shaping productive enactment of mental simulations. Our aim was to identify and illustrate one routine that could positively impact the quality of these interactions when the goal is to develop student-centered adaptive teaching expertise. However, more research should be done to explore how a mental simulation routine functions as a component of a larger system of coaching practices and routines, all of which collectively influence and shape the quality of teachers' learning experience.

In summary, though more evidence is needed, there is strong reason to believe our framework will be empirically robust. Given that we have proposed a novel theoretical framework in a relatively under-explored area of research, we view this study as an important initial 'step' to build the groundwork for future hypothesis testing.

5.0 Discussion and Conclusions

Developing teachers' proficiency for dialogic or 'student-centered' instruction is a challenging yet vital enterprise for improving the learning opportunities and outcomes for a wider range of students in K-12 classrooms. Decades of research have significantly advanced our understanding of how to design and implement high-leverage professional development practices such as instructional coaching (Kraft, Blazar & Hogan, 2018). However, teacher and student learning outcomes remain highly variable both within and across intervention efforts despite significant research expenditure and wide-scale professional development investment by schools and districts (TNTP, 2015). One issue is that professional development research has generally accorded greater attention to assessing the aggregate-level effects on teaching and learning than on theorizing and systematically studying the teacher learning processes and mechanisms that shape differential outcomes across contexts (Lefstein et al., 2020). Therefore, the goal of this dissertation is to contribute to an applied theory of teacher change by examining authentic teacher learning processes empirically (i.e., reflective coaching dialogues) in connection to aligned teaching and learning outcomes (i.e., teacher and student talk moves in classroom discussions) and specific teacher learning principles and context features (video-based reflective coaching).

To this end, the three studies of this dissertation are organized around a set of interrelated questions aimed at exploring the relationship between teacher reflection and classroom discussion practice from multiple perspectives and levels of analysis. These qualitative studies investigate the dynamics of this relationship in the context of a particular instructional coaching context (Online CFC) and instructional domain (dialogic reading comprehension) in order to contribute nuanced

theoretical and empirical insights to professional development research with similar design principles and aims.

5.1 Conceptualizing and Investigating the Relationship between Teacher Learning Processes (reflection-on-action) and Teacher Learning Outcomes (reflection-in-action)

At the broadest level, the three studies of this dissertation contribute insight into the relationship between teacher reflection and practice, an area that has long been of keen interest to education scholars, researchers, and practitioners (Schon, 1983; Sedova et al., 2016). In Study 1, I established that applying a professional vision framework to analyze teachers' reflections was a promising path for better understanding how teacher learning 'happens' in the black box of instructional coaching interactions. However, because I only analyzed aggregate-level changes in teachers' reflections, I could only conclude that, though results suggested evidence of a relationship between the quality of teachers' professional vision and growth in instructional practice (as analyses in prior studies had revealed similarly aggregate-level improvements in practice for this cohort of teachers), I lacked insight into the nature of this relationship at a more nuanced level, or, relatedly, the nature of individual teacher variation in learning and practice trajectories in this coaching context. Importantly, the analyses and results in Study 1 provided a strong foundation for further inquiry into these questions- a vital 'step' for any effort seeking to build a theory of teacher change.

Thus, Study 2 explored these issues in order to create a coherent set of studies that contributed different levels of insight into the relationship between teacher reflection and practice.

As such, the analyses in Study 2 took a ‘deep dive’ into the learning and practice trajectories of two teachers whose profiles offered various fruitful points of comparison (i.e., converging patterns of reflection and practice quality) and contrast (i.e., diverging patterns of reflection and practice quality). Most broadly, the findings lend further support to the conclusions from Study 1 that teachers’ professional vision- especially the quality of their noticing and interpreting of the cause-effect links between their discussion choices and student’s thinking opportunities in reflection- is a key mechanism for growing teachers’ dialogic discussion practice in video-based coaching.

In line with other recent research (see, Correnti, Matsumura, Walsh et al., 2020), these results also lend further support to a larger theory of how teachers learn in the coaching phase of Online CFC. Specifically, I hypothesize that one of the key mechanisms of teacher change in this context is that the joint sensemaking and analyses processes in the coaching reflections facilitates teachers to shift from a more surface-level, tenuous grasp of dialogic text discussion practices (that they learned initially in the workshop) to an understanding of how to actually deploy them effectively in practice. As noted by other researchers, teachers often “add-in” new talk moves while still maintaining existing teaching habits – conversations are still teacher-centered – with no real appreciable difference in student participation (Lefstein et al., 2015). As highlighted by the Study 2 results that showed a substantive presence of dialogic talk moves in teachers’ text discussions prior to coaching, our student discussion quality indicator revealed the critical disconnect between the ‘form’ and ‘function’ of teachers’ questioning practices and the role of coach-guided reflection for building the knowledge and skills necessary to attend to and substantively advance students’ thinking expressed in class discussions.

The findings in Study 2 also add further insight into the analyses of teachers’ reflective practice as suggested by the apparently key role of the ‘in-depth interpretive stance’ dimension of

teachers' professional vision (i.e., knowledge-based reasoning), both at baseline and in terms of growth over time, for effecting high levels of growth in teachers' dialogic text discussion practice. Specifically, my analysis of Jane's trajectory indicated that she perhaps had an important learning advantage in that she showed relatively high levels of interpretive reasoning from the start of coaching, and her skill for critical reflection only exceeded as the coaching progressed. As was discussed extensively in Study 2, Debra's points of contrast on this measure (i.e., her relatively high levels of evaluative stance coupled with a resistance to critical reflection) suggested that this reflective practice dimension might be particularly consequential for teachers' ability to cultivate more rigorous and equitable discussion opportunities that benefit *all* students.

5.2 Identifying and Exploring Sources of Variation in Teachers' Reflective Sensemaking, Learning Processes, and Teaching Outcomes

One major theme of this dissertation, particularly with respect to Studies 2 and 3, was careful attention to the complexities of significant 'external' and individual-level (or 'teacher') factors— e.g., existing knowledge and belief systems, culturally-based narratives and normative assumptions about teaching and learning- and how these factors emerge and take on distinct meanings in teachers' reflective dialogues.

In Study 2, these questions were particularly focused on the influence of tacit beliefs and assumptions for how teachers negotiate the implications of their teaching choices and decisions in as they process evidence from their classroom videos. Notably, my interpretation of the findings centered on the notion of 'resistance' on the part of the teacher who struggled to grow her practice (pseudonym 'Debra'), based on evidence from multiple sources (i.e., the coach's reflective journal

entries, written and verbal reflections). Specifically, I concluded that Debra's apparent resistance to the coach's repeated invitations for her to engage in critical reflection and self-examination, despite her expressed willingness and enthusiasm to do so, appeared to be an especially strong barrier for her learning. I noted in particular the coach's attempts on multiple occasions to prompt Debra to notice the disconnect between, on the one hand, her stated beliefs that all her students are equally capable of rigorous dialogue and on the other, her consistent tendency to undermine these opportunities for her "lower-ability" students in practice.

Indeed, a wealth of research over the past several decades has explored in particular the role of ability-related biases and academic stereotypes- especially those related to race, social class, and gender- for reinforcing systemic inequities and perpetuating impoverished learning opportunities for marginalized students and communities (Philip, 2011; Black, 2004; Steele & Aronson, 1995). Much of this research has emphasized the particularly insidious power of tacit (or 'implicitly-endorsed') beliefs for shaping teachers' classroom behaviors and interactions, as they often co-exist with explicitly-endorsed ('socially acceptable') values and beliefs that obscure their influence in practice. These beliefs often emerge as a 'deficit-oriented' perspective that, despite often being well-intentioned- i.e., wanting to 'help' marginalized students to overcome their 'deficiencies'- undercuts and devalues the social, cultural, and intellectual assets of these students (Delpit, 2006).

Though this research has undoubtedly been instrumental for identifying the scale and influence of these beliefs in classroom learning and education writ large, many of these studies operationalize teacher beliefs in the form of static, standardized measures, and therefore assume (either implicitly or explicitly) a relatively one-dimensional, unilateral influence of these beliefs on teachers' sensemaking and behavior (Philip, 2011). Moreover, particularly in the context

sociological perspectives, there is an overly deterministic assumption that individuals (including teachers) are relatively unable (and often, unwilling) to disrupt deficit narratives and adopt new, more purposeful ways of attributing meaning to their observations and experiences (Philip, 2011).

Aligning with a growing movement in the learning sciences (see Philip & Gupta, 2020 for a review), I propose that Debra's case exemplifies the need to further elevate and disentangle the co-constitutive relationship between individual agency and societal-level notions of power and privilege in learning. I emphasize in particular research around how, on the one hand, mainstream ideologies about student ability and learning shape teachers' pedagogical thinking and sensemaking, and on the other, how these ideologies are uniquely taken up and re-constructed in teachers' moment-to-moment interactions. Striking this kind of balance would allow for an analytic perspective that takes seriously the role of systemic forces and narratives without summarily dismissing or discounting the explicit values and well-intentioned (if perhaps misguided) actions of teachers like Debra. Perhaps most importantly, this approach makes room for the possibility of robust teacher change- not that macro-level forces can be 'overcome'- but that teachers can be supported to recognize and re-articulate damaging narratives and assumptions, diminishing their power to tacitly shape their pedagogical thinking and action (Philip, 2011).

In Study 3, I focused in depth on coaching practice for a single coach-teacher pair to explore what might be key barriers or challenges for teachers' development of adaptive expertise (see Figure 3 of Study 3). Specifically, I endeavored to account for the potential influence of key social and cognitive factors in the conceptual arguments regarding the design of expert-guided professional development that can robustly facilitate teacher knowledge development and conceptual change. I highlighted, for example, the ways in which key teacher learning processes such as counterfactual thinking and conceptual change may be obstructed or distorted by

individuals' tendency to maintain existing knowledge and beliefs systems (e.g., attribute causality to 'external factors'), avoid the negative affect associated with confronting problematic teaching practices (e.g., 'dissonance avoidance'), or just the struggle associated with the highly effortful and often inefficient process of conceptual knowledge development and restructuring.

Moreover, though the vignette represented an 'empirical exemplar' in terms of coach ('expert') facilitation of a MSTR routine, I also highlighted in the vignette key areas where the teacher needed support (e.g., when the teacher reached a 'impasse' in her interpretive reasoning) and described different kinds of moves the coach made in response (i.e., scaffolding moves such as challenging and modeling pedagogical reasoning). This discussion lays the groundwork for more systematic study of the micro-level features of responsive coaching interactions that support teachers' individual learning, beyond the components and quality dimensions that establish the function of MSTR.

Taken together, the arguments and discussions presented in Study 3 contribute a new perspective to the teacher learning and change processes explored in Studies 1 and 2. In particular, by integrating key insights from social and cognitive psychological perspectives, Study 3 could be seen as bringing a fresh 'take' on recent, practice-based teacher learning theory and research that primarily draws from situated and socio-cultural learning theory perspectives. In line with growing calls from social sciences researchers across domains, this effort reflects the notion that education research in general, and teacher learning research in particular, can greatly benefit from a 'de-siloed' approach to advance forward, rather than lateral progress in the field (van der Linden & Mckinney, 2020).

5.3 Methodological Contributions and Considerations

One advantage of the qualitative analyses in these dissertation studies- which featured a combination of descriptive and thematic (Miles & Huberman, 1994) and grounded theory (Strauss & Corbin, 1997) approaches, was that it enabled an exploration of teacher learning processes and outcomes at multiple layers of complexity and specificity. In Study 2, I was able to iteratively construct and explore increasingly complex interpretations of the reflection-practice relationship in the case study analyses, beginning with an examination of similarities and differences in teachers' overall patterns and shifts in reflection and instructional quality (in the first two Results sections) using a combination of descriptive and thematic coding, as well as the fine-grained details of each teachers' development in the context of a specific, shared problem of practice (in the final Results section) that drew on iterative rounds of descriptive and inductive coding to construct key themes and hypotheses linked to a theory of teacher sensemaking and change processes. This combination allowed greater insight into key micro-interactional factors with the potential to explain larger patterns of variation between our case study teachers.

In Study 3, I offered two conceptual frameworks- FATE and MSTR- that aimed to capture key components of an adaptive teaching expertise learning context at different levels of generalizability and context-specificity. For FATE, the key teacher learning 'functions' described in this framework drew from a close analysis and synthesis of existing research to establish the larger 'backdrop' for the design of teacher learning activities in an expert-guided reflection context more generally. In the MSTR framework, I presented a concrete routine for facilitating FATE and detailed the components of this routine in increasingly complex iterations, beginning with the most basic 'descriptive' components, followed by a presentation and detailed description of the quality dimensions that comprise each component and instantiate their function in relationship to FATE.

Finally, an empirical exemplar vignette was used to illustrate the application of MSTR in expert coaching practice. My aim for presenting MSTR at varying levels of detail and specificity was to increase its utility for use by researchers in more or less similar expert-guided teacher reflection contexts (e.g., in different student-centered instructional content domains).

Notably, though Study 3 was primarily a conceptual paper, the thinking and reasoning behind these frameworks was also driven by prior work coding and analyzing hundreds of transcripts of coach-teacher dialogues using a variety of coding frameworks, including one based on mental simulation (manuscript in preparation). Moreover, the expert coach featured in this study played an integral role in the developing, analyzing, and consulting on the conceptual arguments, assumptions and interpretation of the empirical data behind these frameworks. Thus, particularly for the development of the MSTR framework, there was a consistent balance between deductive reasoning based on teacher learning theory and existing research (e.g., to determine the quality dimensions involved for each MSTR component), and inductive reasoning based on our familiarity with the coach's thinking, routines, and dialogues with teachers.

Notably, for each of the three studies of this dissertation, the coach was a part of the team of researchers who collaboratively developed and contributed insights from different areas of expertise. Thus, all studies in this dissertation benefitted from an iterative development process where conceptual frameworks and empirical analyses were continually adapted and refined based on emerging themes and interpretations of the data. These insights are made in the context of a field that is increasingly focused on advancing theory-based frameworks to more systematically examine robust indicators of teacher learning- i.e., expressions of teachers' applied knowledge in authentic learning interactions- in order to support strong inferences about the learning processes that shape differential outcomes in teaching practice (Sturmer, Seidel, & Holzberger, 2016). Thus,

we view as one particular advantage of the frameworks and empirical analyses described in these studies is that they offer a ‘roadmap’ for weaving together different theoretical perspectives that both shape, and are shaped by, the distinct ways in which teachers express their learning in authentic professional development interactions.

5.4 Limitations and Directions for Future Research

Finally, there are a number of limitations to the studies in this dissertation that we believe suggest a number of fruitful directions for future research. First, while there are advantages to the fact that these studies draw from one professional development context (Online CFC) and the work of one, highly skilled expert coach (i.e., this ameliorates a substantial source of potential variation that comes from having multiple professional development contexts and coaches with varying degrees of experience, knowledge, and training), this also raises important questions about the applicability and generalizability of our findings in the field of instructional coaching more broadly. In particular, more systematic conceptual and empirical research is needed to better understand the nature of effective coaching in connection to the distinct learning needs, social-cultural contexts, and goals of the schools and communities in which coaches work (McFadden & Roehrig, 2020).

To this end, particularly in the coaching excerpts and vignettes featured in each of the three studies, this dissertation endeavored to provide some level of insight into the coach’s facilitation role for advancing and scaffolding teachers’ thinking and learning relative to the instructional model and goals of Online CFC. However, more research is needed to study these coaching moves, decision-making processes, and interactions more systematically. I particularly emphasize the

number of social-emotional and relational aspects of the coach's work that were not explored in a substantive way in these studies. Research consistently suggests, for example, the critical role of processes such as trust building and emotional support for effective coach-teacher relationships (Neuman & Cunningham, 2009). Moreover, as has historically been the case with the array of 'learning-focused' or content-based moves a skilled coach uses to elicit and grow teacher learning (though significant progress has been made on this score in recent years, see, e.g., van Es et al., 2014; Zook-Howell et al., 2020; Borko, Jacobs, Seago, & Mangum, 2014), many of these social-relational skills on the part of the coach are implicit in nature. Thus, more research is needed to make these dimensions of a coach's work for preparing, facilitating, and adapting to teachers' learning needs in their interactions explicit and subject to further empirical study.

As mentioned above, the findings from Study 2 in particular call for a more nuanced and systematic explanation beyond a more standard 'ad-hoc' interpretative frame that might simply cast this as a classic case of deficit framing or teacher bias. While this interpretation may have merit, it is also limited in explanatory scope and power, particularly when it comes to a theory of teacher change. Deficit notions related to student ability do not arise randomly or in a vacuum, and we know that an individual's beliefs and perspectives are multi-dimensional and shaped by both micro-scale personal experiences as well as larger meso- and macro-level societal narratives and structures. Particularly when questions arise around the role of teachers' ability-related stereotypes or deficit perspectives, it is imperative to take seriously the role of institutionalized racism and classism, as schools have long served as levers for societal sorting and racial subjugation. Thus, I believe that analytic approaches that recognize the co-constitutive influence of both individual-level teacher sensemaking processes and societal-level narratives about power and privilege on learning would be an especially important direction for future research.

Finally, with respect to Study 3, I emphasize the need for future research to take up and further explore the conceptual arguments that were put forth in support of the FATE and MSTR frameworks for developing adaptive teaching expertise. More research is needed to clarify, for example, the relationship among each of the FATE key functions as a collective mechanism for advancing adaptive teaching expertise and how they apply to different kinds of teacher learning routines (e.g., planning lessons or analyzing artifacts of student work) and expert guided reflection contexts. Similarly, research is needed to investigate mental simulation as a learning construct more generally, and as a framework for informing a teacher learning routine more specifically. For example, much research has developed, especially in teacher preparation and education programs, around the use of simulation-based learning (SBL) environments, which are often based on similar learning principles to mental simulation (e.g., identifying problems, generating hypotheses, and weighing evidence, Bauer et al., 2020; Wildgans-Lang et al 2020) but typically involve computer-based programs and supports or physical enactment (see Chernikova et al., 2020 for a review). One advantage of mental simulation is that it can operate as a learning routine with relatively little material support and without the need for a shared physical space. Moreover, as conceived in the MSTR routine, it is based on teachers' actual classroom interactions and students rather than an artificially simulated environment. To my knowledge, however, this study is the first to apply a mental simulation framework to explore how to support developing adaptive expertise in this kind of PD and instructional context. Most intriguingly, future research could reveal the ways in which SBL and mental simulation can be used synergistically to support teacher learning (e.g., cycles SBL training interspersed with teacher experimentation and mental simulation to construct context-specific alternatives and hypotheses for future action).

5.5 Conclusion

To summarize, building teachers' skill for facilitating high quality student-centered instruction is critical for achieving ambitious 21st century goals for student learning and success in the modern world. However, despite decades of research to conceptualize, study, and implement dialogic and student-centered instructional models, we have failed to 'move the needle' much in terms of improving the learning outcomes and prospects for a wider range of students, particularly those from high-needs communities and low-income schools (McFarland et al., 2017). This dissertation focused on one particular dimension of this highly complex issue- i.e., the relative dearth of theory and research to understand how teachers learn to robustly change their thinking and practice through practice-based professional development.

Notably, the new demands on teachers' professional skill as expressed in reform learning standards has cast a new light on prevailing conceptions of what it means to be a highly effective teacher. In particular, it has catalyzed a shift towards a conception of teaching as a professional domain of work that, similar to other recognized professions such as engineering or law, establishes a distinct shared identity for those engaged in collective intellectual activity and on-the-ground work. As such, teachers are increasingly recognized as professionals deeply engaged with specialized knowledge and inferential thinking and decision-making in the midst of a highly complex and variable problem space. This notion departs significantly from how the work of classroom teaching has long been conceived, wherein effective instruction has traditionally been framed as successfully memorizing and implementing a relatively constrained set of classroom practices and procedures- a view that has long endured in the design of traditional professional development activities (e.g., sporadic, lecture-style workshops) (Kennedy, 2019).

These developments, together with the establishment of more rigorous standards for teacher learning and professional development design features represent encouraging trends in the field of teacher learning writ large. Similar to the advances in our understanding of how students learn best, this field has thus considerably progressed in terms of building our understanding of what kind of teacher learning content and activities are associated with better teaching and learning outcomes. As has been argued in detail throughout this dissertation, the time is ripe for more research to ‘step back’ to seriously consider and build teacher learning theory and process-oriented research in order to advance more consistent and high-quality teacher and student learning outcomes across interventions, schools, and districts.

Appendix A Tables for Study 2

<i>Framework for Effective Text Discussions (QtA dimensions)</i>		
Questioning the Author Dimensions	Example Teacher moves	Example Student Moves
Select a complex text with grist	<ul style="list-style-type: none"> • Select a text with grist/complexity that supports extended responses and meaning-making 	<ul style="list-style-type: none"> • Demonstrate motivation to persist and grapple with challenging content
Segment the text	<ul style="list-style-type: none"> • Identify stopping points that provide opportunities to unpack text difficulties • Plan initial questions and potential follow-up questions 	<ul style="list-style-type: none"> • Engage in making sense along the way
Pose questions to construct the gist of larger text themes and ideas	<ul style="list-style-type: none"> • Ask open-ended questions that support students to respond in more elaborate ways to explain larger text themes and ideas • Ask questions that surface students' potential misunderstandings 	<ul style="list-style-type: none"> • Demonstrate understanding of key ideas in the text • Respond using own words rather • Respond in longer ways that connect ideas within the text
Pose cognitively demanding questions	<ul style="list-style-type: none"> • Ask questions that link text ideas to broader issues in the discipline or world • Ask questions that require text interpretation and analysis 	<ul style="list-style-type: none"> • Form generalizations, claims, and/or arguments about the text

Framework for Effective Text Discussions (AT dimensions)

Accountable Talk dimensions	Example Teacher Moves	Example Student moves
Develop accountability to accurate knowledge	<ul style="list-style-type: none"> • Mark critical ideas expressed by students • Press for accuracy in students' responses • Build on students' prior knowledge 	<ul style="list-style-type: none"> • Demonstrate accurate knowledge of the ideas in the text • Identify knowledge not yet available but needed to address an issue
Develop accountability to rigorous thinking	<ul style="list-style-type: none"> • Challenge students' explanations • Press students to explain their reasoning • Invite students to expand on their thinking • Model reasoning (i.e., think aloud) • Recapitulate ideas expressed in the discussion 	<ul style="list-style-type: none"> • Explain their reasoning about text-based evidence • Test understanding of concepts • Formulate hypotheses based on text evidence • Challenge the quality of each other's evidence and reasoning
Develop accountability to community.	<ul style="list-style-type: none"> • Invite participation to ensure that all students participate in the discussion • Link students' ideas in the discussion (i.e., show how critical ideas expressed by students relate to one another) • Work to keep everyone together • Verify and clarify students' contributions to ensure that the student is understood 	<ul style="list-style-type: none"> • Engage in active participation in classroom talk • Listen attentively to one another • Elaborate and build on each other's ideas • Work to clarify or expand an idea

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