Journey From Data Into Instruction: How Teacher Teams Engage in Data-Driven Inquiry

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Journey from Data into Instruction: How Teacher Teams Engage in Data-Driven Inquiry

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To Maya, whose snuggles, tail wags and long walks kept me going.
Acknowledgements

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# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>V</td>
</tr>
<tr>
<td>CHAPTER 1: INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>CHAPTER 2: THE DATA DOESN’T SPEAK FOR ITSELF. WHAT AND HOW TEACHERS LEARN FROM DATA</td>
<td>6</td>
</tr>
<tr>
<td>CHAPTER 3: WHAT DO WE DO NOW? HOW TEACHERS COLLABORATIVELY PLAN INSTRUCTION IN RESPONSE TO DATA</td>
<td>61</td>
</tr>
<tr>
<td>CHAPTER 4: CONCLUSIONS</td>
<td>108</td>
</tr>
<tr>
<td>APPENDICES</td>
<td>111</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>114</td>
</tr>
</tbody>
</table>
Abstract

Increasingly U.S policy-makers and K - 12 schools are adopting data-driven improvement interventions believing that such initiatives support both student and teacher learning. While widespread, studies examining the impact of such data-driven inquiry programs are decidedly mixed, raising questions about what teachers actually do when discussing data. To address this, I followed three teaching teams engaged in data inquiry in order to understand the individual and shared cognitive processes through which teachers make sense of student data to identify gaps in learning and consequently determine instructional responses. In the first paper, I explore how teachers make sense of student data to identify student-learning challenges. I find one team engaged in strategic data use characterized by a precise focus, methodical data collection, and evidenced-based analysis. This process was supported by the team’s deep knowledge of learning targets, high expectations for students and evidence-based discourse about data. In contrast, the second team was unable to devise a rigorous data collection plan and the third team lacked a clear focus for their inquiry. In the second paper, I unpack how teachers plan instruction in response to gaps in student learning noticed in data. For all three teams, I find that collaboration around instructional responses to data operated like a market place: teachers brainstormed ideas together but made individual decisions about what to transport into their classrooms. Furthermore, teachers’ choices were constrained by their shared instructional repertoire. As a result, data inquiry appeared to facilitate teachers targeting instruction to match student needs but did not appear to promote teachers learning new instructional approaches.
Chapter 1: Introduction

Reform efforts in U.S. K-12 schools increasingly rely on the use of data to inform instruction (Jennings, 2012). Such data-driven improvement strategies typically require teachers to examine student assessment results with their colleagues in order to plan instructional responses. Many argue that such data use will allow teachers to identify not only strengths and weaknesses in student learning, but also the underlying causes for any student errors (Bambrick-Santoyo, 2010; Goldring & Berend, 2008). With such knowledge of student learning at hand, teachers are expected to adjust their instruction to target the unique needs of their students (Bambrick-Santoyo, 2010; Goldring & Berend, 2008). In this manner, policy makers and school leaders argue that data-driven instruction supports both student and teacher learning and thus can drive improvement efforts and organizational learning in schools (Goldring & Berends, 2008).

The use of interim assessments is one of the most common forms of data-driven interventions (Datnow & Hubbard, 2015). In such interventions, students take standards-aligned assessments at regular intervals and teachers collaboratively examine the results in order to identify student-learning challenges and make instructional adjustments. Such adjustments may include re-teaching content, differentiating instruction or experimenting with new instructional approaches. Despite their prevalence, research of interim assessments interventions reveals mediocre outcomes.
Rigorous empirical studies have shown no effect of interim assessment interventions on student achievement. For example, Quint, Sepanik, and Smith (2008) evaluated the effect of the Formative Assessment of Student Thinking in Reading (FAST-R) intervention in Boston Public Schools, an assessment designed to mirror the end-of-year state tests in Massachusetts. Schools were provided with the assessments, student results and an instructional coach who met with teachers to review results and plan an instructional response (Quint et al., 2008). Yet, no improvements in student achievement were detected when compared to similar schools or to the school’s performance in prior years. In a similar study, Henderson, Petrosino, Guckenbug, & Hamilton, (2008) examined the effect of quarterly benchmark assessments in middle school mathematics in selected schools in Massachusetts. Two years after implementation, their quasi-experimental design detected no difference in mathematics achievement when comparing schools that used the assessments to those that did not (Henderson et al. 2008).

Other interim assessment programs have been no more successful, suggesting that the design of any one program does not explain the disappointing impact. For example, Cordray and colleagues (2012) conducted a random control trial to determine the effect of the Measures of Academic Progress (MAP) intervention, an assessment and training system designed to support teachers’ differentiation. Cordray et al. (2012) found that MAP teachers were no more likely to differentiate instruction compared to non-MAP teachers and the program had no impact on reading achievement. More recently, West, Morton, and Herlihy (2016) designed a randomized control trial to determine the effect of a school adopting the Achievement Network (ANET) intervention on student
achievement. Similar to FAST-R, ANET provides schools with regular standards-aligned assessments in reading and math and a data coach to support teachers as they use the data to make instructional plans (West et al., 2016). While teachers’ self-reports suggested a positive effect of the program, there was no discernible impact on student achievement (West et al., 2016).

Even worse, some interventions designed to improve teachers’ knowledge of and use of assessment results have shown negative effects on student achievement (Schnieder & Meyer, 2011). At the same time, other studies have identified teacher teams that are effective at using student data to improve teaching and learning (Gallimore, Emerling, Saunders & Goldenberg, 2009; Timperley, 2009). Given all the policy support for data-driven instructional interventions, what might explain the mixed results?

To understand this variability, researchers have examined contextual factors that may impact the process (Coburn & Turner, 2011; Datnow & Hubbard, 2015; Little, 2012). For example, studies have explored the effect of the content of the assessments (Cosner, 2011; Shepard, 2010), the role of leadership (Booher-Jennings, 2005; Diamond & Cooper, 2007; Shepard, 2010), and the impact of structured protocols (Christman et al., 2009; Datnow, Park & Kennedy-Lewis, 2013). Yet even when teams experience the same data-driven intervention in the same context, only some effectively improve teaching and learning as a result (Timperley, 2008; West, Morton, Herlihey, 2016).
To understand such differences, we must examine what teachers actually do when collaborating around data and how they enact instruction in response to such data driven collaborations (Little, 2012). In particular, research has yet to examine the individual and shared cognitive processes through which teachers make sense of student-learning challenges and enact instructional responses. Such an examination is important because how teachers make sense of data-driven instructional initiatives underpins the success or failure of such policies (Spillane, Reiser, & Reimer, 2002), and may explain the variability of enactment observed in schools.

The papers in this dissertation aim to unpack the cognitive and social processes by which teacher teams gain knowledge from assessment data and then use such knowledge to shape instruction by directly observing both processes. Each draw on qualitative data collected as I followed three teacher teams in the same district engaged in same data inquiry model and receiving support from the same facilitator.

In paper 1, I take a close look at how teachers collect and analyze student data to identify learning challenges. I ask, “How do different teacher teams collect and interpret data to identify student-learning problems? How are such processes shaped by teachers’ prior beliefs, knowledge and interactions with each other?”

In paper 2, I turn my attention to examine how teachers plan instruction in order to respond to learning challenges noticed in data. I ask, “How do different teacher teams design instructional responses to student learning problems identified from data? How are
such instructional choices shaped by teachers’ prior beliefs, knowledge and interactions with each other?”

Together, these papers present a detailed account of how teachers engage in data-inquiry in order to improve teaching and learning.
Chapter 2: The data doesn’t speak for itself. What and how teachers learn from data

Abstract

Increasingly, U.S policy-makers and K-12 schools are adopting data-driven improvement interventions, believing that such inquiry supports both student and teacher learning. While widespread, studies examining the impact of such data-driven inquiry interventions are decidedly mixed (Cordray et al., 2012; Henderson et al. 2008; Quint et al., 2008; West et al. 2016), raising questions about what teachers actually do when discussing data. To address this, this study follows three teaching teams engaged in data inquiry in order to understand the individual and shared cognitive processes through which teachers make sense of student data to identify gaps in student learning. I find that one team engaged in strategic data use characterized by a precise focus, methodical data collection, and evidenced-based analysis. Furthermore, this team had deep knowledge of learning targets, high expectations for students and engaged in detailed discourse leading to a shared understanding of the data. In contrast, the second team was unable to devise a rigorous data collection plan and the third team lacked a clear focus for their inquiry.

Introduction

Policies promoting teacher collaboration around student learning data have become increasingly popular in U.S. K-12 schools (Jennings, 2012). Such data-driven improvement strategies typically require teachers to collaboratively examine student assessment results and adjust their instruction in response. Such policies are predicated on the notion that teachers learn unique and actionable knowledge about student learning from data—knowledge they would not have access to were it not for the analysis of data.
Yet while much is known about the assessment literacy teachers need to read data reports (Datnow et al., 2007; Kerr et al., 2006; Schildkamp & Kuiper, 2008; Schildkamp & Poortman, 2015), much less is known about cognitive processes by which teachers interpret data. By interpret, I mean to indicate the process by which teams translate observations and patterns noticed in data reports into claims about student learning. It may be that some teams are more effective at making sense of data reports than others and that differences in how teacher teams learn from data may help us understand the variable impact of data-driven inquiry programs. As such this study will examine how and what teachers learn from analyzing student data.

**Literature Review**

While there are various data-driven inquiry programs, they share common processes believed to support the kind of teacher learning that will lead to improvements in instruction and student achievement. First, teachers must identify a source of data related to an important learning target. Next, teachers collaboratively analyze the data source in order to identify gaps in student learning—learning gaps teachers presumably would not know about were it not for the data analysis. Then, teachers must determine how best to address these learning gaps. Finally, teachers implement an instructional response and assess its impact. In this manner, the cycle continues as teachers take in new data and make further adjustments to their teaching. In this study I explore one key component of the data-inquiry process, namely, how teachers generate unique and actionable knowledge about student learning through analyzing and interpreting data (Cosner, 2012).
To date, most research on data-driven inquiry has focused on the contextual factors that shape how teachers learn from data, such as the role of leadership, testing systems and structured collaborative time (Avila de Lima, 2003; Booher-Jennings, 2005; Datnow et al., 2007; Datnow & Park, 2013; Diamond & Cooper, 2007; Hamilton et al. 2009; Honig & Venkateswaran, 2012; Kelctermans, 2006; Mandinach & Honey, 2008; Shepard, 2010; Supovitz and Taylor, 2003). Despite the importance of these contextual factors, even when teams experience the same data-driven intervention in the same context, only some effectively improve teaching and learning as a result (Timperley, 2009; West, Morton, Herlihy, 2016), suggesting that other factors must also be at play. Such discrepancies have prompted calls for a closer examination what teachers actually do when collaborating around data (Little, 2012). An emerging body of research has begun to explore how teachers’ prior beliefs, knowledge and the social process of constructing meaning from data shape what and how teachers learn from data. While the body of research on context informs the methodology of this study, it is the body of research on how teachers make sense of data that this study builds upon.

Thus, the first goal of this study is to closely examine how teacher teams interpret data in order to gain unique and actionable knowledge about student learning. The second goal is to describe how this process is shaped by teachers’ prior knowledge, beliefs and interactions with one another. In this study, I use a cognitive framework as a lens to analyze how teachers interpret data as this may illuminate important differences in how teacher teams interpret student data. Below I first review the research on how teachers
interpret data. I then turn to reviewing what is known about how teachers’ knowledge, beliefs and social interactions shape their data use.

**How Teachers Interpret Data**

Research has shown that teachers have a propensity to notice certain types of learning challenges in data (Booher-Jennings, 2005; Cosner, 2011; Shepard, 2010), and frequently use data to determine what content to reteach and to whom (Goertz, Olah & Riggan, 2009). For example, when teachers use multiple-choice interim assessments, they tend to examine individual item performance and plan to reteach how to solve specific types of questions without attention to underlying student misconceptions (Oláh & Riggan, 2010; Shepard, 2010). Relatedly, while some teachers concentrate on students conceptual understanding when examining data (Goertz, 2009), most teachers tend to notice procedural misconceptions on assessments and respond with a procedural remediation, failing to attend to students’ misconceptions (Oláh & Riggan, 2010). Additionally, when assessments report students’ performance categories on high-stakes tests, teachers tend to focus attention on students just below proficiency (so called “bubble students”) in order to boost the overall percentage of students reported as proficient (Booher-Jennings, 2005).

Furthermore, the relationship between the assessment design and the underlying content and skills students are expected to master shapes how teachers analyze data (Cosner, 2012). Some assessments, such as district administered benchmark tests, explicitly map to content standards, while other assessments, such as teacher-generated
assignments, do not. When teachers examine data from assessments not explicitly tied to content and skill standards, they must draw connections on their own about the relationship between assessment items and the related skills and knowledge that is developmentally appropriate for students before using the data to identify relevant gaps in learning (Cosner, 2012). Finally, not all data sources are created equal—some assessments are more cognitively demanding and better designed to elucidate students’ conceptual understanding while others are poorly related to the desired student outcomes (Cosner, 2012).

**Teachers’ Beliefs and Knowledge**

Rather than blank slates, teachers are active learners who bring prior knowledge and beliefs about students and instruction when enacting new policies (Coburn, 2001; Cohen & Ball, 1990; Putnam & Borko 1997; Spillane & Thompson, 1997; Spillane, 1999; Spillane, Reiser, & Reimer, 2002). Such beliefs and knowledge influence how teachers frame problems (Munby & Russell, 1992), whom they seek help from (Coburn, 2001), how they respond instructionally (Cohen & Ball, 1990), and how they interpret data-driven inquiry policies (Coburn, 2001). Some research suggests that teachers may use data to search for evidence that is aligned with their current knowledge of content and pedagogy (Honig & Coburn, 2008). Indeed, studies have found that teachers are more likely to enact policies that match their existing practice thereby preserving rather than changing their instructional practice (Coburn, 2001; Cohen & Ball, 1990; Spillane, 1999).
Teachers’ current content and pedagogical knowledge appear to play a particularly important role when teachers and school leaders make sense of emerging ideas about learning and teaching (Putnam & Borko, 1997; Spillane & Thompson, 1997; Spillane, 1999). For example, some research suggests that school leaders and teachers will view new academic standards through the lens of their current content knowledge in order to validate rather than challenge their beliefs about what students need to learn about a given subject (Honig & Coburn, 2008; Spillane & Zeulli, 1999). Relatedly, past research on reforms in mathematics education has shown that changes in teachers’ instruction relied on their substantial content and pedagogical knowledge, without which teachers often only made superficial changes (Spillane & Thompson, 1997). Indeed, reform attempts often rely on a knowledgeable, socially connected, committed teacher leader who is able to engage others in the process of learning new instructional methods (Boudett & Steele, 2007; Spillane & Thompson, 1997).

Central to the questions in this study, evidence suggests that content and pedagogical knowledge also shapes how teachers interpret data (Coburn & Turner, 2011; Mandinach & Gummer, 2016). For example, studies suggest that a lack of subject matter knowledge can be an obstacle when making inferences from data (Coburn & Turner, 2011; Timperley, 2009). Additionally, teachers who lack a clear understanding of content standards are unlikely to notice patterns in the data that reflect students’ mastery or shortcomings related to such standards. Insufficient pedagogical content knowledge can also hamper attempts to use data to improve instruction teachers struggle to design instructional responses to data (Timperley, 2009; Young & Kim, 2010).
Some evidence suggests that teachers’ beliefs about the data itself and their ability to affect students’ outcomes shape how they interpret data. For example, Schildkamp and Kuiper (2010) found that while some teachers believed data could offer new knowledge of student learning, others believed that their years of experience and classroom-based knowledge was superior to any insights into student learning data analysis might add. Relatedly, others have found that teachers predominantly used data reports to validate already-held beliefs about student learning rather than glean new insights into student thinking and misconceptions (Goertz, 2009; Oláh & Riggan, 2010). Others have found that teachers need to believe in the data—judging it to be accurate and valid—before they are willing to engage in analysis (Kerr et al., 2006; Oláh & Riggan, 2010). Furthermore, teachers who demonstrated a high internal locus of control are more able to take responsibility for deficits noted in data, while teachers with a high external locus of control are more likely to blame factors outside of their control when data reveals gaps in student learning (Schildkamp & Kuiper, 2010).

Others have uncovered how teachers’ beliefs about the purpose of data analysis shape their collaborative use of data. For example, in their study on middle school mathematics teacher teams, Horn et al. (2015) found that teams’ underlying data use logics shaped how they interpreted data. Some teams used data reports to determine which students needed additional instruction or specific interventions, so called ‘resource allocation logic’, while other teams used data to understand student thinking and make instructional adjustments, so called ‘instructional improvement logic’ (Horn et al., 2015).

Finally, not surprisingly, some have found that teachers need basic data literacy and analysis skills (Datnow et al., 2007; Kerr et al., 2006; Schildkamp and Kuiper, 2008; Schildkamp & Poortman, 2015), such as how to read data reports, interpret statistical measures, and formulate a question based on data.

**Situated Cognition**

At the same time, scholars observe that teachers’ knowledge and beliefs are shaped over time by interactions with others (Coburn, 2001; Putnam & Borko 1997; Spillane, Reiser, & Reimer, 2002; Spillane, 1999). From this situated cognitive perspective, “knowledge is embedded in context”, or rather, teachers’ mental models for understanding initiatives are shaped by the social context, cultural norms, and dominant beliefs of their school community (Spillane, Reiser, & Reimer, 2002, p. 404). Many argue that the social context a teacher experiences as she makes sense of policy initiatives can be the catalyst for learning and instructional change (Coburn, 2001; Spillane, 1999; Spillane, Reiser, & Reimer, 2002). Studies examining embedded learning find that teachers need time to come to a shared understanding of new policies with their colleagues (Coburn 2001; Penuel et al., 2007; Spillane, 1999). Such shared meaning-making is most effective when teachers engage in iterative, reflective and detailed dialogue about their instructional attempts to enact reform (Coburn, 2001; Spillane, 1999) in an environment typified by high levels of relational trust (Bryk & Schneider, 2002). Furthermore, teams need access to expert knowledge via their own training or collaboration with external partners (Spillane & Thompson, 1997; Spillane, 1999). In this
manner, learning is a collaborative process—teachers may learn by following another colleagues’ example or by grappling with colleagues’ divergent viewpoints (Putnam & Borko, 1997). Not all groups, however, foster learning: teachers whose content and pedagogical knowledge and/or beliefs about students are lacking or too similar often fail to surface assumptions that would lead to questioning or adjusting current practice (Coburn, 2001; Hill, 2001; Spillane, 1999; Spillane & Zeuli, 1999) and teacher groups that lack relational trust are less likely to take the risks inherent in attempts to change instruction (Bryk & Schneider, 2002). On the other hand, more heterogeneous teacher groups offer more opportunity for deliberation and learning, but if the gap between knowledge and beliefs is too great, productive communication may be undermined (Coburn, 2001).

Following this line of thought, some scholars have examined the interactions between teachers when collaboratively engaged in data inquiry. For example, Timperley (2009) studied schools in the same system that implemented the same data-driven literacy program. The researchers observed salient differences in the conversations teachers had around data (Timperley, 2009). In schools that saw greater gains in student achievement, data conversations were imbued with a sense of urgency, teachers triangulated across data sources in order to diagnose student-learning problems and drew connections between student data and teaching practice (Timperley, 2009). Meanwhile, in schools that saw less gains in student achievement, teachers privileged professional autonomy over collaborative sense-making (Timperley, 2009).
The literature on Professional Learning Communities has also revealed patterns of social interactions between teachers when discussing issues related to teaching and learning more generally. For example, some teachers focus their attention to the demands of immediate teaching tasks while putting inquiry discussions on the back burner (Horn & Little, 2010). Other teams are unable to manage conflict productively or are hampered by existing team norms and assumptions about learning that inhibit discourse (Horn & Little, 2010). Such group dynamics can limit opportunities to question and examine teachers’ beliefs about teaching and learning, and thus collaboration can lead to reinforcing current practice rather than promoting growth (Clement & Vandenberghe, 2000).

Taken together, the studies reviewed above suggest teachers’ beliefs about students, data, data inquiry, knowledge of content and pedagogy and the levels of relational trust among the team are all likely to shape what and how they learn from data. For data-inquiry to achieve its aims, teachers need access to content and pedagogical expertise as well as data sources they understand how to interpret and judge to be valid. Furthermore, how teachers interact with each other will likely affect how they create shared meaning from data and learn from one another. Teachers need time to make connections between data and teaching, including testing and refining new instructional methods. To date, most studies on data inquiry rely on interviews and surveys (Little, 2012) with few directly examining teachers engaged in data analysis. Furthermore, those that do observe data inquiry tend to draw on isolated data analysis conversations rather than following teachers over time. As such, this research aims to closely describe the
process by which teams translate observations and patterns noticed in data reports into claims about student learning by directly observing teachers engaged in data inquiry over an entire inquiry cycle. This process includes not only examining teachers’ discussions around data reports—what types of data do they notice, how closely do they attend to the evidence in reports, how to they draw out patterns of student learning—but also how teachers collect and organize data around a particular focus area. Furthermore, I pay particular attention to how teachers’ knowledge and beliefs shape this work—how do they draw upon the content knowledge, beliefs about their students, or pedagogical knowledge? I also attend to how their interactions with each other shape how they interpret data—how do they manage disagreements and/or build off each other’s ideas? Do they come to a shared understanding of student-learning challenges? Thus, in addition to describing how teachers work with data, I also intend to unpack the cognitive processes that shape this process.

Thus, patterns of cognition may help us understand how teachers construct meaning from student data and thus is a useful framework to explore why some teams are able glean unique and actionable knowledge about student learning from data, while others are not. In order to guide this inquiry, I ask the following question:

_How do different teacher teams collect and interpret data to identify student-learning problems? How are such processes shaped by teachers’ prior beliefs, knowledge and interactions with each other?_

**Methods**
I used a comparative case study approach for two reasons: 1) it allowed me to carefully examine, describe and compare the processes by which multiple teacher teams make sense of student data; and 2) such comparisons allowed me to explore how teacher teams use data to identify student-learning challenges and why some teams are more able to leverage data to gain insight into student learning than others. This is an exploratory study designed to generate hypotheses about how teachers interpret data.

Sample

My analysis focused on three teams of teachers located in one urban district, Chester Public Schools\(^1\) (CPS). CPS serves approximately 55,000 students, 20% of which are classified as student with disabilities, 29% English Language Learners and 49% as economically disadvantaged. CPS has a reputation (Huberman, Miles & Saldana, 2013) for successful school reform and robust data-driven inquiry initiatives. This study is concerned with what distinguishes teams that use the data-inquiry cycle to gain new knowledge from data from those that attend to data superficially. As such, I did not recruit teams that lack the basic organizational and leadership supports to proficiently engage in data-inquiry. Rather, by comparing teams who used data more effectively to drive instruction to more typical teams, I surface salient differences in the cognitive aspects of data use.

I purposively sampled teacher teams from the group of schools working with the CPS Inquiry Facilitators. CPS Inquiry Facilitators are district-level coaches dedicated to

\(^1\) All names—districts, schools, participants—are pseudonyms.
supporting schools’ data-inquiry cycles. As the CPS Inquiry Facilitators work closely with all the teams, I recruited teams for the study from their recommendations (Huberman, Miles & Saldana, 2013). My final sample consisted of three teams who work with the same facilitator, Susan. Based on her prior work with these teams, Susan judged one of the teams to be “data shapers” and the other two teams to be “data validators”. By “data shapers” I mean to indicate teams that use data to shape instruction, while “data validators” use data to validate current instructional methods. By limiting the sample population to teacher teams who work with the same CPS Inquiry Facilitator, I ensure that teams use the same data-driven inquiry framework and receive comparable levels of support. Indeed, the inquiry facilitator provides many of the contextual factors thought to promote inquiry (e.g. structured meeting agenda, use of protocols, professional development in inquiry model). Furthermore, as part of the application process for Inquiry Facilitator support, schools demonstrate their organizational ‘readiness’ to implement the district’s preferred data-driven initiative, including strong principal leadership, teacher buy-in and dedicated meeting time for teachers. Thus, by sampling only from this group, I increased the likelihood that the teacher teams experienced similar levels of leadership and organizational supports within their schools, allowing me to focus specifically on differences in the data interpretation process rather than larger, macro-level issues.

Two teams in the study, a kindergarten team and a pre-kindergarten team, work in the same early childhood center, Honeycomb School, which serves students in pre-K through 1st grade. The last team is a 3rd grade team located in a K-8 school, Oreville
School. With one exception, all classroom teachers in all groups were female, though their race, age, and experience teaching varied. See Table 1 below for team composition data.

**Table 1: Selected Teacher Characteristics**

<table>
<thead>
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<th>Role</th>
<th>Gender</th>
<th>Race</th>
<th>Years Teaching</th>
<th>Years at this school</th>
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<td>Kindergarten Honeycomb School</td>
<td></td>
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<tr>
<td>Abigail Classroom teacher, K Inclusion,</td>
<td>F</td>
<td>White</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Team leader</td>
<td></td>
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<td></td>
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<td>Jessica Classroom teacher</td>
<td>F</td>
<td>African American</td>
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<td>3</td>
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<td>Lila Classroom teacher, K ESL</td>
<td>F</td>
<td>Cape Verdean, African</td>
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<td></td>
<td></td>
<td>American</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Karmen Classroom teacher</td>
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<tr>
<td></td>
<td></td>
<td>American</td>
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<td>Sean Reading Specialist</td>
<td>M</td>
<td>White</td>
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<td>Pre-K Honeycomb School</td>
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<td>White</td>
<td>5</td>
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<td>team leader</td>
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<td>Age 1</td>
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<td>18</td>
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<tr>
<td>Jasmine</td>
<td>Classroom teacher, Team leader</td>
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<td>23</td>
<td>8</td>
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<tr>
<td>White</td>
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<tr>
<td>Karen</td>
<td>Classroom teacher</td>
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<td>10</td>
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<td>White</td>
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<td>Marigold</td>
<td>Classroom teacher</td>
<td>F</td>
<td>14</td>
<td>10</td>
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<td>White</td>
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<td>Malia</td>
<td>Classroom teacher, SEI</td>
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<td>21</td>
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<td>Puerto Rican</td>
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CPS promotes a model of data inquiry described by the Data Wise Project at Harvard University. The Data Wise Improvement Process is an 8-step cycle with three overarching phases. In the prepare phase, teachers develop collaborative structures and build their understanding of relevant standards and assessments. In the inquire phase, teachers examine multiple data sources, identify a student-learning challenge, observe instruction, and discuss instructional weaknesses in order to identify what is lacking in their instruction related to the student-learning challenge. Finally, in the act phase, the team determines an instructional response and makes a plan for how they will enact the response and assess progress (see Figure 1 for an outline of the process). Under ideal circumstances, the Data Wise Improvement Process leads teachers to not only meet student learning needs noticed in data, but also to learn new instructional strategies.
previously unknown to the team (Boudett & Murnane, 2013). In this manner, Data Wise, when implemented well, supports the sustained, detailed and reflective collaborative inquiry thought to promote instructional improvement. Relevant to the questions in this study, I expect to observe teachers use their knowledge of standards and assessments to collaboratively diagnose a student-learning challenge, namely work through the prepare phase and partially work through the inquire phase. I have worked as an instructor, consultant, and course designer with the Data Wise Project for 4 years. As such, I have a deep understanding of the Data Wise cycle, but also carry potential bias about the program based on my own work.

*Figure 1: The Data Wise Improvement Process*

Data for this study was collected in two ways: interviews with teachers and observation of teacher team inquiry cycle meetings. All meetings were audio-recorded and I took field notes. Data collection spanned 6 months from January 2017 to June 2017. In this time period the two Honeycomb School teams completed two inquiry cycles and the Oreville team completed one inquiry cycle. At Honeycomb, teacher team meetings occurred weekly; at Oreville meetings were biweekly. In total, I observed 12 Honeycomb kindergarten team meetings, 13 Honeycomb pre-k team meetings, and eight Oreville 3rd grade team meetings. For the purpose of this study, I analyzed data from one inquiry cycle for each team, thus I transcribed only a portion of the team meetings observed—six kindergarten meetings, eight pre-k meetings, and six 3rd grade meetings.

In the first interview, teachers were asked about their professional background, beliefs about teaching, learning, and data inquiry, knowledge of instruction and students, and prior experience working collaboratively with colleagues. At the end of the study, teachers were interviewed again to discern what and how they learned from colleagues through data inquiry and their understanding of data-driven inquiry process. See details of interview protocols in Appendix A.

Observations of teacher team meetings provided evidence of how teams interpreted data to identify student-learning challenges. Observational data was also used to hypothesize what beliefs and knowledge teachers brought to bear in conversations with colleagues, what ideas got taken up by the group and which were squelched, and the extent to which teacher discourse around data was iterative, reflective, and detailed.
Observations of data meetings also allowed me to collect data on how, if at all, disagreements amongst teachers and/or teachers modeling new ways of thinking promoted learning. In addition to examining the cognitive process at play, observational data also allowed me to confirm or dispute whether or not teams identified by CPS Inquiry Facilitators were indeed data shapers or data validators.

**Analysis**

I employed a pattern matching strategy (Yin, 2013) to draw connections between individual and social cognitive processes and whether or not teams were “data shapers” or “data validators”. The analytic goal of pattern matching is to determine if the empirical patterns observed in the data are consistent with the hypotheses about the relationship between cognitive processes and data-inquiry team performance presented above (Yin, 2013). Both individual teachers and teacher teams were treated as cases and cases were coded sequentially (Miles, Huberman & Saldaña, 2013). Throughout the process, I avoided using the Data Wise framework and associated terminology in order to protect against potential bias. Rather, I simply used descriptive language and avoided evaluating teams against the Data Wise framework.

In order to understand how teacher teams collected and interpreted data to identify student-learning challenges, I treated each team as a case. Observations of team meetings were coded to describe teachers’ interaction with data (e.g. plans to collect data, types of data collected, inferences made from data etc…) and with each other (e.g. seek advice, engage in protocol, express disagreement etc…). Initial codes were derived from the
research question and field notes; other codes emerged from the data. For each team/case, I wrote a memo after the first round of coding, describing the process by which teachers collected and interpreted data. I then compared and contrasted across memos in order to surface salient differences in how teams engaged in this process. To do so, I organized the descriptions of data interpretation from the memos into a matrix (Miles, Huberman & Saldaña, 2013), with each row representing a team/case and columns representing patterns of data analysis within each case. I iterated between writing memos to synthesize patterns of data interpretation across cases and re-analyzing the data to look for evidence that confirmed or refuted the tentative claims in the memos.

In order to understand how cognitive processes shaped what teachers learned from data, I treated each teacher as a case. In the first iteration, interviews and observations were coded to describe how each teacher drew on prior beliefs and knowledge when analyzing data as well as how she interacted with others. This round of coding used a set of provisional codes suggested by the literature, theoretical framework, initial field notes and/or the research questions. For each teacher/case, I wrote a memo after the first round of coding, identifying tentative patterns of how this particular teacher drew on prior beliefs and knowledge when analyzing student data. In the second round of coding, I looked across teachers within a team to look for patterns of individual and situated cognition that shaped how the team engaged in inquiry, again writing memos describing the cognitive processes that shaped each team’s data use. Finally, I looked across teams in order to compare and contrast patterns of cognition noted within teams. Such comparative analysis allowed me to distinguish how patterns of cognition varied
across teams. Like above, I organized the patterns from the two sets of memos into a matrix (Miles, Huberman & Saldaña, 2013), with each row representing a teacher/case and columns representing patterns of cognition and patterns of data analysis within each case. I iterated between writing memos to synthesize patterns within and across cases and re-analyzing the data to look for evidence that confirmed or refuted the tentative claims in the memos.

**Findings**

Through the data inquiry process, teams first determined a focus area for their inquiry and then drew upon student data to identify a student-learning challenge they wanted to address. The focus areas and student-learning challenge for each team are highlighted in Table 2.
Table 2: Focus Area and Student-learning challenge for Each Inquiry Team.

<table>
<thead>
<tr>
<th>Focus Area</th>
<th>Data Sources</th>
<th>Student-learning challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honeycomb kindergarten</td>
<td>Multi-task Nature of Reading</td>
<td>#1: Students are struggling to apply multiple reading strategies to decode unknown words.</td>
</tr>
<tr>
<td></td>
<td>Running records; Concepts of print;</td>
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</tr>
<tr>
<td></td>
<td>Sight word inventory</td>
<td>#2: Students are struggling to use 1:1 correspondence and read sight words.</td>
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<tr>
<td></td>
<td></td>
<td>#3: Students are struggling with sight words and overall concepts of print.</td>
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<tr>
<td>Honeycomb</td>
<td>Social-Emotional Learning</td>
<td>Students do not yet have the schema for positive peer interactions necessary to engage in positive peer interactions OR communicate and seek help when necessary.</td>
</tr>
<tr>
<td>pre-k team</td>
<td>Behavior and Emotional Screening System</td>
<td></td>
</tr>
<tr>
<td>Oreville 3rd grade team</td>
<td>Writing</td>
<td>Student essays</td>
</tr>
</tbody>
</table>

How do different teacher teams collect and interpret data to identify student-learning problems?

Differences in the types of data collected and the ways in which teachers organized and analyzed data resulted in some teams surfacing unique and actionable knowledge from data while others did not. At this stage in the Data Wise process, ideally teachers triangulate across multiple data sources and use their knowledge of standards and assessments to identify a student-learning challenge. The Honeycomb kindergarten
engaged in strategic data use characterized by a precise focus, methodical data collection, and evidenced-based analysis. The Honeycomb pre-kindergarten had a precise focus, but struggled to methodically collect data, and thus their analysis lacked robust evidence. The Oreville 3rd grade team struggled to precisely define a focus for inquiry and thus data collection and analysis was haphazard. Thus, only one team, Honeycomb kindergarten, appeared to possess the knowledge of standards and assessments necessary to diagnose student-learning challenges as expected by Data Wise. Finally, in all teams, teachers made sense of student learning data by relating it to their informal classroom observations, though the Honeycomb kindergarten did so in a way that elucidated their inferences from data, whilst the Honeycomb pre-k and Oreville 3rd grade teams did so in lieu of careful data analysis.

**We know what we are looking for, how to find it, and what to do with it:**

**Honeycomb kindergarten team.** The kindergarten team articulated a precise focus on reading skills, systematically collected relevant student data and engaged in evidence-based analysis. Together, these efforts helped them generate new and actionable knowledge about students’ reading development.

The Honeycomb kindergarten team strategically selected data sources from all those available to them in their environment in order to understand students’ current reading skills. They used these multiple data sources to determine, refine, and monitor student-learning challenges in reading. Rather than using these measures haphazardly, however, the team intentionally drew from these sources to inform distinct portions of the
inquiry cycle: standardized assessments such as the concepts of print inventory, sight word inventory and running records at the start of the cycle, which helped identify students’ problems with decoding; classroom observations of students reading midway through the cycle, which deepened their understanding of the learner-centered problem by directly observing where students struggled; and the Text Reading and Comprehension (TRC) and the Dynamic Indicator of Basic Early Literacy (DIBELS), at the end of the cycle to assess the impact of their work. Notably, the team was also strategic at each stage of the cycle; for instance, during the initial cycle, they administered the running record to students who had already demonstrated they could read, while students who had yet to demonstrate reading fluency were assessed on concepts about print. Lila articulated the team’s philosophy about the assessment selection:

...if you have some that are reading, then I don't think you should waste your time doing the Marie Clay [concepts of print inventory], because you already know that they can read. I think you should give them the [running record]. So that way when we get all the information, we can better differentiate.

This deliberate use of data characterized Honeycomb kindergarten team’s work throughout the observations collected for this project.

The kindergarten team’s work with these assessments was also organized and detailed, often disciplined by the rich data displays that teachers generated, manipulated, and made inferences from. As shown in figure 2, the teachers purposively designed their data tracker, listing the skills for each assessment in each column of a spreadsheet with
student names grouped by class along the rows. This allowed teachers to look for patterns in their classes on specific skills and attend to extremely low or high scoring skills.

Figure 2: Honeycomb Kindergarten Team Skill Tracker

The data tracker supported concrete discussions about learners’ problems. For instance, scanning a list of students “in the red” (non-mastery), “yellow” (emerging-mastery), and “green” (mastery) zone for the Sight Word Inventory (far right column), Karmen and Abigail noted:

Karmen: I noticed that our students are struggling with the sight words. Well, many of our students are struggling with sight words.

Abigail: Yup. There are only 11 kids in Green. And then there are 36 kids in the red. (silence) Any other thoughts?

This attention to the evidence in the tracker in order to support inferences about gaps in student learning was common as teachers worked with the spreadsheet to determine student-learning challenges.

The team also organized individual students’ performance across the rows (by student) using the same color scheme. Within each ability group, the team then identified the skills specific students struggled with:
Lila: For our yellow kids, they all need sight words. But for the yellow kids, we also feel that they need the 1-1 correspondence. But I think that once we start... combining the two together - working on the sight words with the 1-1 correspondence, manipulating themselves. I think they'll work on that... what did you guys say about the yellows?

Abigail: Agreed. We talked more about the reds and the kids who weren't really reading. We didn't really touch upon the yellows too much. But I would agree that it is sight words, but also that piece of tracking while reading. So maybe for the Yellow group, our [student-learning challenge] could be something like students are struggling to... read sight words in context... and students are struggling to track.

Above Lila and Abigail started to identify the target skills for particular groups of students—namely expanding their sight word knowledge and developing their tracking skills while reading. This precise inference about students’ skill gaps was typical of the kind of actionable knowledge the Honeycomb kindergarten team gleaned from data.

Throughout this process, Honeycomb kindergarten teachers used their informal observations to elucidate the learning challenges noticed in data, corroborating and bringing to life patterns in the spreadsheet data. For example, when discussing ‘green’ students who know many sight words, Lila and Abigail had the following exchange:

Lila: ...When they came across a word they didn't know, they didn't have any strategies [for decoding] to help solve them... Cause they knew the sight words, but when they came across a word they didn't know, they would just say, 'I don't know that word' because they didn't know any strategies.

Abigail: I notice the same thing with one of my students, with [the book] that was at the park. He was like, 'I can play ball.' And [the picture] was like, him catching or something. And he didn't... like we haven't talked about lips the fish [a reading strategy] and...he was just using... the picture. And he wasn't really using any strategy with the word.

Lila: Yeah like 'likes'. Play-ing. Played. So they don't know how to attack those words. Like even if they were sight words. Like I remember the word was 'likes', And I said, "well, honey, can you tell Ms. Bayo is there any part of that word that
you do know?" And she's like, "no." So I think that for the high kids we should work on reading strategies ...

In this exchange Lila and Abigail shared concrete observations of students reading in their classroom. Such anecdotes complemented the inferences from data and provided more insight into how a particular group of students struggled to make sense of words that either they did not yet know or were related to sight words they already did know. Thus, the team grounded their observations from data in their informal observations of students in their classroom.

The team was also strategic in the ways in which they triangulated across multiple data sources to refine and revise their understanding of the student-learning challenges. For example, midway through the cycle, teachers analyzed videos of students reading in order to surface the specific reading mistakes students were making. The team sampled a ‘typical’ student categorized as red, yellow and green based on the start of the cycle data. As the team watched the video, they recorded what reading strategies students used (e.g. using the pictures) and what mistakes they made (e.g. skipping words or misreading words) in order to determine ‘the next level of work’ in reading for that student and students with similar reading skills.

By purposively sampling students and using observations to identify specific strategies and mistakes, the team intentionally used data to generate new knowledge about their learners. For example, the Reading Specialist, Sean, and a teacher, Jessica, had an exchange about a student in ‘yellow’ below:
Sean: And he was even ahead of his pointing sometimes

Jessica: Yeah, sometimes.

Sean: So he was lucky to catch up at different times.

Jessica: Like really working on that. He knows some of the words but it's like he skips. He is either skipping or... not, cause even when he goes ahead, like when he's pointing ahead, he was able to catch back up. Because then he was like reading and reading correctly. But when he got to a word he didn't know he stops and he's like on the correct word but like not.

Sean: That's going to mess him up.

Through analyzing the video, Jessica and Sean noticed that the student is not tracking his reading by pointing at the words on the page correctly, an important early reading skill that demonstrates a student understands 1-1 correspondence between a word on the page and a spoken word. Later in the conversation, Jessica’s colleague, Lila, and Sean used this observation to determine what the student needs to work on next with the rest of the team.

Sean: If he can settle, I think his skills are going to really fly.

Lila: But at this point in the year, I think that that's ... like where they're at ... he just needs to work on learning some more words. But clearly he knows enough like for the 'my' the 'he' you know to look at the picture. I think he just needs to work on his sight word bank.

Sean: And his 1-1 because he really needs to work on his 1-1.

Jessica: His 1-1 and what he does when he gets to words that he doesn't know. Cause he can't just stop reading the rest of the words on the page.

In this exchange we see how teachers moved from noticing that the student was skipping words while reading to determining he needs more practice with 1-1 correspondence between words on the page and spoken words. In this manner, they
generated new and actionable knowledge from the videos, a facet of video analysis that was common in the meeting.

Thus, the kindergarten teams’ precise focus, methodical data collection, and evidence-based analyses all helped the team to triangulate across multiple data sources to generate new and actionable knowledge from data.

**We know what we are looking for, but don’t know how to find it:**

**Honeycomb pre-kindergarten team.** The pre-kindergarten team had a clear focus on four behaviors related to social-emotional standards but struggled to craft a data collection plan that would support the kind of evidence-based analysis observed in the kindergarten team. Indeed, there were fewer relevant data sources available to them and thus they relied primarily on anecdotal data to guide their inquiry. The pre-kindergarten team drew on a district provided assessment called the Behavior and Emotional Screening System (BESS), observational tools designed by the team, and classroom anecdotes.

The pre-kindergarten team focused their inquiry on social emotional learning standards and hoped to cultivate four associated behaviors in their students: caring, sharing, trading and turn-taking. The team primarily drew on two administrations of BESS data, one at the beginning of the cycle to identify a student-learning challenge and again at end of the inquiry cycle in order to determine the impact of their work together. Yet this data—the only measure of students’ social-emotional skill provided by the
district—was poorly organized to meet their needs, as it gave no insight into the skills they were targeting, but rather was designed to identify students at risk of developing behavioral and emotional problems.

To complement the BESS data, the team made plans to collect data that would give meaningful information about their target skills, yet this data collection process lacked the methodical planning and organization observed in the kindergarten team. Indeed, they often failed to execute their plans or did not analyze the data collected. For example, as part of their action plan, teachers created a “Kindness Tree”, shown in image 1 below. When they observed students engage in one of their four target behaviors—caring, sharing, trading or taking turns—the student earned a ‘leaf’ that was placed on the tree with their name on it. Teachers may, for example, have used the tree to determine which behaviors were least present amongst their students or which students had earned the least leaves. While this data collection process was well-designed to support inquiry around socio-emotional skills, the teachers did not use it to engage in an evidence-based analysis that might surface new knowledge about their learners.

*Image 1: The Kindness Tree*
Instead, when discussing the Kindness tree, the team attended to how the data was collected and questioned its validity, never using the data in the tree to learn new information about their students. See the exchange below:

Libby: What do we notice about the kindness tree? The areas of strength, weakness and student distribution.

Miranda: Honestly, [I] could have put…more [student names] on the caring, definitely the caring and sharing. There would be more [names up] if I had been more diligent.

Libby: My taking turns is very teacher-directed. So, I wasn't giving out leaves unless they were doing it by themselves.
Aaron: This data stuff, with this was hard for me. Like I had a kid one day who had a leaf for moving when someone said excuse me, the next day he deliberately sat in her spot, so she would say excuse me and he would move and get another leaf (laughter). I was like, that's not quite how this is suppose to be working.

Above, Libby began the conversation with a prompt that may have led the team to make evidenced-based claims about what skills students had mastered. However, Miranda responded by expressing concern about how the data was collected. Libby and Aaron continued in this vein, further questioning the data collection process validity. This was typical of the pre-kindergarten team—opportunities to analyze data were often derailed by concerns about how the data was collected or how to interpret the data. Instead of responding to these concerns by devising new data collection plans to address them, the team often invoked anecdotal evidence. Thus, concerns about the data collection process prevented the team from using the data available to generate new information about their students’ socio-emotional skills.

Other plans to methodically collect observational data were never enacted, and thus the team had a paucity of data driving their inquiry. For example, the team discussed designing a chart with columns for each target behavior (caring, sharing, trading, taking turns) and rows for each student in order to track which students had demonstrated each skill in a given week. Such a data report would allow them to engage in the evidence-based gap analysis and targeted grouping observed in the kindergarten team. However, the teachers never used this chart to collect data, blaming snow days for interrupting their plans.
Instead, teachers’ conversations about student behavioral data were saturated with informal observations and anecdotes about students, rather than methodical data collection and evidence-based analysis. It is this anecdotal data that the team used to diagnose student-learning challenges. For example, after teachers examined the Kindness tree, they have the following exchange:

Libby: ... turn taking and trading were the hardest. Caring and sharing were kind of like ones that we have under our belt.

Susan (Data Inquiry Facilitator): So, we have like caring. Is that true in other classrooms too? And sharing are, quote – unquote, easiest to manage and then trading and turn taking are hardest...

Libby: Right. Well in my classroom what I was telling Susan is that turn taking and definitely trading are teacher-directed for the most part. We have to. Some of my friends can do it, but most of them need a teacher there to support it, they need a timer to be set. They're not going to do it on their own.

Aaron: Yeah. I have similar. It's like if you set up an activity where there is turn taking built into it, some of them could do it and some of them can't. Trading is a completely alien concept in my room... It's not a solution to any problem that they are working on.

Above we see teachers readily shared their impressions of student progress as well as areas in need continued attention. However, teachers did not draw on data to notice any patterns beyond what they believed based on their experience in the classroom. It may be that they did not find any useful information about students’ social-emotional behavior in the data available to them—indeed the district-provided data was a poor match for their inquiry—and hence, favored anecdotal data. Thus, it is their informal observations of students that they used to monitor progress, not methodically collected data.
When teachers did attend to the data available to them, they noticed information about individual students rather than looking for patterns across groups of students or skills as the kindergarten team did. For example, when analyzing the BESS data, they noted which students were at elevated risk, but the team was not able to use the data to notice gaps in skills nor to create ability-based student groupings as the kindergarten team did as the data was not organized to report on students’ skills, simply their emotional or behavioral risk level. The same was true when looking at the Kindness Tree; while this data was collected to be able to compare across the four target skills, teachers did not look for or report patterns across the skills nor did they group students based on their skills. Indeed, neither of these data sources were organized to promote the kind of pattern-seeking that the kindergarten team’s tracker prompted. Thus, unlike the kindergarten team, the pre-kindergarten team did not look for patterns across their data to surface unique knowledge that might motivate an instructional response.

The paucity of data sources available to the team and their struggle to create their own data collection plans meant that teachers in the Honeycomb pre-kindergarten team relied heavily on anecdotal data to diagnose student-learning challenges. In this manner, teachers were unable to triangulate across multiple sources of data to determine a student-learning challenge as recommended by the Data Wise Improvement Process.

**We don’t know what we are looking for: Oreville 3rd grade.** The Oreville 3rd grade team struggled throughout the cycle to come to consensus on the writing skills central to their inquiry. While they agreed on a student-learning challenge, “While
students understand that they need to use evidence in support of a claim to answer a text-based prompt, they do not consistently answer the prompt completely, including explaining their thinking,” their inquiry often veered away from this concern. This lack of focus crippled the team’s ability to methodically collect data. As a result, analysis was guided by teachers’ impressions, rather than grounded in evidence. Similar to the other teams, the Oreville 3rd grade drew on a combination of district-administered interim assessments as well as assessments from Achieve the Core and writing tasks from their Expeditionary Learning curriculum.

In contrast to the Honeycomb Kindergarten team’s focused and methodical data collection plan, the Oreville team more often brought a data source that was readily available to them, rather than intentionally choosing a data source with the specific writing goals in mind. For example, at the midway point in the cycle, they drew on an informative writing piece about Japanese culture from their English Language Arts curriculum and a narrative writing piece from the district assessment—yet these two samples were from different genres of writing, which muddled the focus of the analysis. Further, it is not clear what their relationship was to the team’s student-learning challenge about fully answering text-based prompts. Thus the 3rd grade team prioritized convenience over purpose when planning which data to analyze.

Furthermore, when teachers did analyze writing samples mid-way through the cycle to monitor progress, they did so without a focus on particular writing skills related to their student-learning challenge. Instead, teachers discussed what they noticed in their
students’ writing and these observations covered a broad range of writing skills, from students’ use of transition words, use of evidence, appropriate use of capitalization, and quality of topic sentences just to name a few. In fact, almost no attention was to given to whether or not students answered the prompt completely, a core part of their learner-centered problem. The exchange below, Jessica invites teachers to share what they noticed after skimming the essays:

Jasmine: So I put 15 minutes into look at [the essays] and identify the trends—things that proficient writers do because that's what we've been kind of working off of that students use when writing paragraphs independently. So we wanted to look at the ones that we taught to see what they actually did independently...For our goal to be, what can we do to help improve students' writing in response to reading?

... 

Karen: Not all of them are using strong leads after we've spent a couple days doing mini-lessons.

Jasmine: Like the sieve again. Oh now do the transitions words? You want us to do that now? Or you just want to talk about it just like, what's happening?

Karen: Like when do they know they need to own it and do it, you know?

Jasmine: So this is a big thing here. Where is the ownership?

Notice as the teachers discussed the students’ essays, they did not make connections to their student-learning challenge. Indeed, Jasmine prompts teachers to attend to a broad set of skills with the phrase ‘trends proficient writers do’ and ‘writing in response to reading’. As a result, they briefly discussed a skill only tangentially related to the student-learning challenge—strong leads—before the conversation devolved to complaining about why students are still struggling with this skill. This lack of focus on particular skills resulted in a haphazard analysis of data that often turned into
complaining about students. This stands in stark contrast to the Honeycomb teams, both of which engaged in discussions about skills directly related to their student-learning challenge.

The team’s lack of focus when examining student writing was in large part a result of their inability to come to consensus on the writing skills related to their student-learning challenge. Indeed, they devoted one meeting during the cycle to examine and synthesize across the various writing rubrics—one from the district, one from Achieve the Core and another from their district-mandated curriculum. Yet the team struggled to use these various indicators to come to explicit agreement about what writing skills they were looking for in their data. As a result, they often left their meetings having named a myriad of weaknesses in student writing without clarity on which they planned to tackle. Furthermore, because they did not come to consensus on the set of writing skills to look for, they did not methodically collect data, thus they were unable to engage in any rigorous skills analysis or targeted student groupings. Rather they simply read student essays and shared what they noticed. In this manner, the team failed to develop the rich understanding of standards promoted by the Data Wise Improvement Process before analyzing data.

Furthermore, when teachers examined external assessments, they often questioned the design of the test and validity of the results rather than attending to underlying student misconceptions. For example, at the end of the cycle, the team examined an Achieve the Core multiple-choice assessment in order to track student growth from the beginning of
the year. Notably, they attended to assessment items on reading comprehension, thus veering away from their focus on writing. When looking at the results, the team noticed overall improvements in the percentage correct and attended to the lowest performing items. However, when they analyzed items, the hypotheses the team made about why students answered a question incorrectly are more focused on test design rather than student proficiency with the writing skills associated with their student-learning challenge. For example, see the exchange below where Marigold and Susan discussed the ‘trickiness’ of certain items:

Marigold: 4 was tricky but it was fair. But you had to really think about that word thick. Because it wasn't it was very difficult. Whereas five I thought was unfair...

Susan (District Inquiry Facilitator): So 4A what are the steps for making jam... yeah this is key ideas and details. You know but it's just in a slightly different format.

Marigold: Cause it says to cook it and then it says to strain it. But then you said you said you recocok it to make it thick. So a lot of kids saw cook, strain and that's it.

Here Marigold’s analysis focused on the structure of the item and how students may have been confused by how the item was written. Rather than leading the team to a deeper understanding of student learning or reading comprehension, such observations were more likely to promote discussions about how to prepare students to answer certain types of prompts.

When teachers on the Oreville 3rd grade team did examine data, they often doubted the evidence, claiming that students knew more than the test could detect. For example, when examining the district-administered assessment results, Marigold...
commented, “Some of these results don’t match what they’re actually doing in the class-
room.” In another example, Karen commented on her students’ scores saying,

> *I think it's informative to drive instruction. But I also think that some kids do more for you in a classroom than they show up on data to some extent. It's sometimes I think there's a lot of discrepancies in what they can do independently in the classroom. And then when they take a test what it looks they look like on paper.*

In both these comments teachers expressed doubt that the assessment accurately measures their students’ skills. Perhaps this lack of confidence in what can be learned from data contributed to this team’s weak data usage.

In short, because the Oreville team was unable to clearly define which writing skills they wanted to track, their use of student data was often haphazard, with different teachers attending to different aspect of writing. Thus their inability to gain clarity on the standards, as Data Wise expects, hindered their use of data.

**What Shapes Data Use?:**

**Teacher Knowledge of Standards & Assessments and Beliefs about Students.**

Above, we see the Honeycomb kindergarten team was able to triangulate across multiple data sources in order to identify a student-learning challenge. On the other hand, the Honeycomb pre-K team struggled to find or develop useful assessments to examine students’ social-emotional skills and the Oreville team struggled mightily to come to a shared understanding of the standards on which they wanted to focus. Below I explore differences in the teams’ individual and social cognitive patterns that may help us
understand why one team was more able to use data to identify unique and actionable knowledge about students than the other two teams.

An initial step in this analysis constituted comparing the Honeycomb kindergarten, Oreville 3rd grade and the Honeycomb pre-K to isolate differences in the individual and social processes that could underlie these different outcomes. In doing so, I drew up a list of potential factors, some linked to the literature and some emergent from observations and interviews themselves. I summarized how these factors differed for each group in a data matrix, then drew out the most consistent and persistent themes across both teams and meetings.

From an individual cognition perspective, two facets predominantly shaped how teachers made sense of student learning data: their depth of knowledge in the chosen focus area and their beliefs about students’ capacity to learn. The Honeycomb kindergarten team, a higher-performing team, possessed deep knowledge of students’ reading development and associated assessment tools and held high expectations for all students, whereas the other two teams, Honeycomb pre-k and Orville 3rd grade, demonstrated less knowledge of their focus area and lower expectations for students.

**Honeycomb kindergarten team**

*Deep knowledge of content and assessment.* Teachers on the Honeycomb Kindergarten team demonstrated a strong understanding of reading development that supported their ability to design and use assessment data to diagnose learning challenges.
Two of the teachers on the team, Abigail and Lila, had earned masters degrees in reading and the school reading specialist, Sean, also participated on the team. Such expertise allowed teachers to intentionally collect reading data; they knew what discrete skills they were looking for and thus they strategically selected assessments that would provide data on those skills and organized their data spreadsheets around those skills (see figure 2 above). In addition, the team also understood the developmental milestones of reading development. For example, they checked to see that students had mastered concepts of print (e.g. print has direction) first, then attended to sight word mastery, and finally to students decoding strategies. You can see how the teachers used this knowledge in the previous exchange between Lila and Abigail about a student reading. They first attended to the student’s mastery of sight words and then discussed his decoding strategies in order to determine what further support he needed. In this manner, the teachers used the data to determine where students fell on a continuum of reading skills in order to identify what skill support they needed to progress.

*High expectations.* In addition, teachers on the Honeycomb kindergarten team expressed universal high expectations for their students as young readers. Indeed, many were drawn to teaching in order to close achievement gaps. As Karmen expressed in her interview when asked why she chose to become a teacher:

> I want to help decrease the gaps. I want to make sure that every student that comes in my class is going to learn. Is going to have high expectations and is going to come out of my class at benchmark or above benchmark regardless of their abilities or what they can do.
Strong beliefs in all students’ capacity to learn shaped how teachers talked about current learning challenges. Rather than seeing poor scores as an indicator of students’ inability, teachers simply interpreted data as a progress monitor that gave them valuable information about students’ current skills so that they could identify what to work on next with any given student. Below, Lila and Sean (reading specialist) discussed a student’s struggles with sight words:

*Lila:* But her English, her conversational English, is very good. She talks. She got a five in her oral language, which is proficient. It’s in the reading and writing but that was because when she took, like when they registered her to come to school.

*Sean:* But her exposure probably is kinda limited.

*Lila:* Her Mom speaks English.

*Sean:* Oh she does? Good.

...

*Lila:* And she has two older sisters who are teenagers and they speak English. It’s her dad that speaks Spanish. So if she had taken, if she had gone, her mom never showed up for school before June, she’d have been in a regular classroom.

*Sean:* Okay.

*Lila:* So I think it’s a lot of like just the reading … a lot of just practicing and showing her… you need to learn your sight words… A lot of the reading strategies are the things she needs.

The exchange began with Lila naming a problem a student is having in reading, which she immediately followed by naming the student’s English Language strengths. When Sean incorrectly assumed English was not spoken at home, Lila was quick to correct him and moved to describe actions she will take (give student more opportunity to practice) in order to help the student make progress with reading sight words in context. In this
manner, Lila was able to name what a student is struggling with, reminded herself of the students’ assets and then expressed the expectation that the student will make progress if Lila gives her the right kind of support. This was typical of the kindergarten team—they focused their attention on what they could do as teachers to support reading development and rarely blamed students or families.

**Honeycomb pre-kindergarten team**

*Knowledge of content, but limited knowledge of assessments.* Much like their kindergarten colleagues, the Pre-k team possessed knowledge around the target skills and standards of their focus area which was grounded in developmentally appropriate expectations for social-emotional learning. This is most evident in the relationship the team identified between the social-emotional learning standards, the student-learning challenge and the target behaviors. As articulated by Libby:

> *We're focusing on standard SEL 11—the child will demonstrate beginning personal social and ethical responsibilities. The context that we have been focusing on is student-to-student conflict, and we figured out that our learner-centered problem is that students do not yet have the schema for positive peer interactions necessary to engage in positive peer interactions or to communicate and seek help when necessary.*

The team further distilled their focus to four target behaviors: caring, sharing, trading and turn-taking. Because the team was able to come to a shared understanding of the standard and target behaviors, their inquiry cycle was tightly focused.

Team consensus and shared knowledge around the target skills shaped their inquiry cycle. Like their kindergarten colleagues, this shared understanding facilitated
coherent discourse around student data and instructional strategies. All teachers understood they were looking for evidence of the 4 skills—sharing, caring, turn-taking and trading—when looking at data.

However, the Honeycomb pre-k team lacked knowledge about how to collect social-emotional learning data and the district level social-emotional data available to them provide little useful information. For example, while the team received training from a district representative and a score interpretation guideline, the team expresses doubts about what they could learn from the BESS data.

Aaron: I don’t know how much I should trust this stuff. I don't really understand how they arrive at these scores.

Libby: That's true.

Aaron: And I mean I'm not a psychologist or statistician so I'm not going to understand it.

Aaron’s concerns seemed to permeate among the group as the BESS data, which categorizes students at various risk levels, was a poor tool for gaining new insight into the team’s student-learning challenge (see table 2 above). Yet it was the only district-provided social-emotional data available to the team.

Attempts to collect their own data were also hindered as the team expressed confusion about how to accurately collect social-emotional learning data. When discussing using an observational checklist, Libby expressed doubt that it was an appropriate data collection tool, arguing that a student’s behavior will change based on
the environment he or she is in (e.g. recess, classroom, cafeteria) and thus evidence of behavior in one environment is not a good indicator of progress.

One team member, Isadora, did share productive ideas about how best to collect data:

*Any time we find assessment for this age level it's anecdotal. And you know because even when you go into the work sampling system that the early childhood recommends, that's anecdotal. So, I mean we could do it as a check[list] - like how many times they were being kind and have a rubric... are we looking for a specific amount?*

Here Isadora suggested using an observational checklist for each target behavior so that students are ‘checked off’ when they demonstrate the behavior once. While this idea was endorsed in the meeting, it was never put into practice. Because the team lacked data, diagnosis of student-learning challenges was driven by informal classroom observation.

*Beliefs about students’ capacity to learn.* Some teachers on the Honeycomb pre-k team also expressed deficit views of students and/or families, suggesting that they didn’t feel a sense of self-efficacy in developing the target skills for certain students. For example, when looking at the Kindness Tree, Miranda made the following comment:

*The ones that have the empathetic characteristics continue to get the caring ones. The ones that are able to share and trade. It's always the same ones. You know I don't have to think about it, I know this is the names I'm going to be giving the leaves to. And I'm thinking, is it sometimes, you know, personality too... Maybe next year it's going to come and they'll be able, you know, doing it a lot more consistently. But I look at some of them and say, it's not in the cards for them right now.*

In this comment, Miranda attributed student behavior to fixed student personality characteristics (e.g. ‘empathetic ones’ or ‘personality’) with little expectation that
students not yet behaving appropriately were going to make progress. This deficit view was not universal on the team, indeed Isadora stood out as an exception to this mindset as she often communicated her belief that students could grow if she invested the right coaching, but it was common.

**Oreville 3rd grade team**

*Limited knowledge of content and assessments.* Compared to the other two teams, the Oreville 3rd grade team possessed considerably less knowledge about the writing skills embedded in the standards. This lack of knowledge hampered their ability to select, design and use assessment data in order to diagnose student-learning challenges. Indeed, the lack of knowledge resulted in data collection and analysis that appeared more haphazard compared to the focused and systematic inquiry observed in the Honeycomb kindergarten team.

This lack of knowledge may have been a result of the recent adoption of the Common Core Standards and their concurrent increased writing demands, a lack of coherence across available writing rubrics, and/or teachers’ disparate writing training. Indeed, the team analyzed PARCC narrative writing prompts and sample responses to build an understanding of what writing was expected of 3rd grade students, noting that the model responses were more complex than they anticipated, with clear evidence, organization, and descriptive imagery.
As mentioned previously, at one meeting they attempted to synthesize across multiple writing rubrics but failed to come to clear consensus about what writing skill they would target. As a result, data collection was not focused or systemic and teachers were guided by what they happen to notice in student work or in classroom observations.

*Low expectations of students.* Like the Honeycomb pre-k team, some members of the Oreville 3rd grade team also expressed deficit views of the students. When discussing student data, a culture of “I taught it, they just didn’t learn it” often prevailed. For example, in an exchange above, Karen reported that students are not consistently using strong leads even after the team has done some mini-lessons on the topic. Jasmine responded by saying “like a sieve again” and wonders about “the ownership” of the student learning. In this manner, she seemed to place the blame on the students for not learning what she has taught. In an interview, Karen also expressed doubt that all of her students were able to meet the writing expectations:

*Do I think that a lot of these people that are in the far below basic are reflective what they can do? ... I hate to say this, some of them are going to stay in [below basic] because the accommodations they're on, you know cognitive abilities things like that.*

Such deficit views of students created an obstacle when the team examined data. Instead of using data to learn something about their students’ skill mastery and gaps, these beliefs reinforced a fixed mindset about students’ abilities.

**Detailed Conversations and Consensus Building.** From a situated cognitive perspective, two aspects of teachers’ interactions with each other differentiated the teams:
the level of detail in teacher discourse about student data and the team’s ability to manage conflict and come to consensus.

**Detailed dialogue, strong consensus: Honeycomb kindergarten team.** In Honeycomb kindergarten team, discussions of student data were characterized by detailed conversations about student learning grounded in evidence from the data they examined. This is also true when the team discussed what data they wanted to collect. For example, in one meeting they reviewed videos of students reading a book. After observing one video, the team noticed several aspects of the students reading: the student pointed at words as she read, that she dropped contractions at the end of words, that she attended to the meaning of print as evidenced by her ability to self-correct, that she made sense of the print as she reads almost like a ‘think aloud’, and that she utilized her own background knowledge while reading. Such detailed conversations around one student’s reading proficiency allowed the team to come to a clear consensus about this student’s particular needs in order to make progress on her reading skills.

Additionally, the Honeycomb kindergarten team came to a clear consensus on how they would collect data and what patterns they noticed in the data. For example, when teachers first examined student-reading data, Karmen and Lila had the following exchange:

*Lila: So, I noticed, they are struggling with the words, with sight words.*

*Karmen: No, some of mine aren’t.*

*Lila: But I felt like the ones in my class who are [getting sight words] it’s because they knew some words, they knew some words when they started kindergarten.*
**Karmen:** Hmm some of them, but I noticed that the ones who are green are also ... the ones who are already reading with the exception of one of the students. So they know their sight words and that is how they are able to read ... So one student got 1, but it is usually the same students.

**Lila:** We can write it. I think that working on sight words will impact all the kids.

**Karmen:** They still need to learn more anyways

Notice in the exchange that Lila and Karmen initially disagreed about how to interpret the data, with Lila claiming sight words are an area of concern for students and Karmen questioning whether or not that is true for all students. Yet by the end of the exchange they came to agree: all students can benefit from working on sight words.

Detailed discourse and consensus supported a coherence to this team’s inquiry cycle—all teachers worked on the same problem and used subsequent meetings to learn more about students’ reading skills and/or design instructional responses that addressed the gaps they observed in the data.

*Little detailed discourse, strong consensus: Honeycomb pre-kindergarten team.*

In the Honeycomb pre-kindergarten team, conversations around student data lacked both detail and clear evidence. As previously mentioned, teachers struggled to collect rigorous data on students’ social-emotional behavior and were unable to make meaningful use of the data that was available to them. As a result, learning challenges were often arrived at quickly with little rigorous discussion of data. In the exchange below, we see how teachers at times avoided using the data available to them in favor of anecdotal data:
Susan (Inquiry Facilitator): Before we move from the kindness tree... was there any noticings you had about like who was getting leaves, where, or how many leaves? Any patterns.

Libby: I have a group of girls who understood that they were going... That I wanted them to be caring, take turns, and share to get leaves and they did it and they came and said OK I get blue leaf now. I get a yellow leaf now. There was definitely...It spurred behaviors I guess. But then some of the other kids just didn't...

Isadora: I would try next time the tree in the classrooms so they could see it better. I was having a hard time and I still have leaves that I didn't put up yet. Yes it's on my desk. Because every time I think about going over there. So. It doesn't have all of our numbers there.

Libby: They probably only have one or two for each kid because the first time they got them like I was very vigilant about bringing the child up there and having them put it up. And as I got down the road, it wasn't.

Notice that Susan, the district inquiry facilitator, began the exchange by calling the teachers’ attention to the data in the Kindness Tree. Yet both Libby and Isadora shifted the conversation away from the data towards either an anecdote (Libby) or an idea for future implementation of the Kindness Tree (Isadora). Indeed, in this data meeting, teachers failed to engage with the data present in the tree.

While their conversations about data lacked detail, the Honeycomb pre-kindergarten team was able to come to clear consensus. While they largely relied upon classroom anecdotes to arrive at the four target behaviors, once articulated, these four behaviors framed their subsequent work and much like the kindergarten team, brought coherence to their inquiry cycle.
**Little detailed discourse, weak consensus: Oreville 3rd grade team.** The Oreville 3rd grade team’s discourse around data lacked detail and, at times, appeared superficial. This team also struggled to come to clear consensus about exactly what learning challenges they observed in the data. As a result, teachers were guided more by their personal observations, rather than drawing upon any shared understanding grounded in evidence from data when identifying student-learning challenges. For example, in one meeting teachers spent 15 minutes skimming student-writing pieces on Japanese culture. After which, Karen and Jasmine had the following exchange:

Karen: *I mean I listened to my kids read theirs orally for the most of them at this point. And I notice that... They haven’t... Not all of them are using strong leads after we’ve spent a couple days doing mini-lessons.*

Jasmine: *Let me ask you a question. When you say not everybody is writing leads, what are, be specific, what are they doing?*

Karen: *like numbers? They're just writing... A topic sentence or going right into bowing and tea are big parts of Japanese culture. So, they are going right into the details.*

Karen began by making a claim about students’ skills (not all of them are using strong leads). When pressed by Jasmine to be more specific, she gave two observations (they are just writing topic sentences or going into details), though she did not give a concrete example from student work nor did she share how many students failed to give strong leads. In fact, it is not immediately apparent that a strong lead could not be embedded in a topic sentence. Without more details, it is hard to understand exactly what students struggled with nor how pervasive this challenge was.
The lack of detailed dialogue and consensus building resulted in an inquiry cycle that lacked coherence across teachers. Indeed, each teacher appeared to be addressing a different student-learning challenge when her instruction was observed. Thus, even though the team had agreed to one student learning challenge, it did not appear to give focus to their inquiry cycle.

Of note, one team member stood out as a notable exception to this trend. Marigold often discussed student work in great detail, grounding her observations in the evidence. Below, she shared some of her observations after reviewing students’ paragraphs about Japanese culture:

... most of my class did do a topic sentence... it might not have been the most creative lead but at least most of them did say like here are some customs in Japan. Here are some customs and traditions from ancient and modern Japan or this paragraphs is about traditions and customs of Japan. Do you want to know about customs in Japan here is a paragraph about them. So then most of them did do that at least...

However, because teachers attended to data superficially and failed to come to consensus on target reading skills, their teaching practice remained largely individualized.

**Discussion**

Three dimensions of data use differentiated the teams’ processes: clarity on what skills they were addressing, a strategy to collect and organize data on those skills, and an evidence-based analysis of data. Furthermore, these dimensions were dependent on each other; teams were unable to methodically collect data if they were not clear on the skills they were tracking, and evidence-based analysis was predicated on rigorous data
collection. Thus, teams that were unable to successfully codify their knowledge of standards and assessment early in the Data Wise Improvement Process, struggled when they attempted to use data to make inferences about student learning.

The results from the cases presented here suggest that processes are more productive when, collectively, teachers have a rich knowledge of standards and assessments as well as the belief that, with the right kind of support, all students can learn. Indeed, the knowledge that teachers brought to the inquiry cycle around the focus area appeared to largely shape how they engaged in data analysis. Such individual knowledge is likely a result of the information available to them in their environment: what is known in the research base, what resources the district provides, and what types of trainings teachers have received. The Honeycomb kindergarten team benefited greatly from drawing on a rich and coherent knowledge base on reading development. In the early 1990s, the National Institute of Child Health and Human Development (NCHID) made research in early childhood reading a priority. Subsequently the National Reading Panel distilled a knowledge base on early reading. Indeed, we know a great deal about the developmental milestones of early reading and there is a wide array of assessments to measure the important skills. Such knowledge has been infused in teacher preparation and professional development. The Kindergarten team were the beneficiaries of a coherent knowledge base that they were able to draw upon in data analysis.

Comparatively, the Honeycomb pre-K appeared to possess the necessary knowledge around students’ social-emotional learning, but lacked access to useful assessments of these skills or the knowledge necessary to design their own. Finally, the Oreville 3rd
grade team was hindered by the paucity of knowledge about how students learn to write. The 3rd grade teachers’ own training had no consistent or coherent guidance on helping students write; they were provided with multiple, and sometimes contradictory, indicators of writing from the district curriculum and assessment materials. It is no wonder they struggled to make sense of what skills mattered the most.

Despite literature suggesting disagreement was essential for learning, in these cases, disagreement often caused teachers to revert to individualized practice with little incentive to come to agreement. The team in which teachers already had strong consensus on important skills and learning, grounded in a robust research base, was more able to leverage data to improve student learning. Across the teams in this study, data worked best to help teachers strategically leverage the knowledge and skills they already had by helping them identify what students needed and then providing instruction to match that need. Data inquiry did not prove to be a fertile ground for these teams to identify and come to understand learning challenges they had not previously observed.

**Implications**

Data inquiry does not happen in a vacuum, rather teachers draw upon a myriad of knowledge and information acquired over the course of their career when making sense of data. Such knowledge is developed through teacher training, continuing professional education and district-provided professional development. All of which is built upon a research base. In this study, when inquiry was built upon a strong foundational
knowledge base, the teachers were able to use data to target students’ needs. Yet when
the foundational knowledge was weak, data inquiry did little to generate new knowledge.

Thus, policy makers would be wise to structure inquiry initiatives in conjunction
with other forms of professional development and knowledge building activities as this
study suggests that data-inquiry is most successful when teachers use data to strategically
deploy their knowledge of student learning and instruction.

Furthermore, teachers need access to useful assessments and experience
interpreting results. In this study, assessments designed to track specific skills associated
with student development in a content area were the most helpful to teachers;
assessments designed to mimic high-stakes testing that relied on multiple choice items
and projected proficiency levels, on the other hand, did not provoke meaningful
engagement around data for teachers.

Finally, this study also points to the importance of research on how students learn
particular content areas. This difference in knowledge between the Honeycomb
kindergarten team and the Oreville 3rd grade team is likely explained by the coherent
knowledge base on how students learn to read compared to the paucity of such
knowledge of how students develop as writers. The field has come to consensus on how
students learn to read, and as a result, the Honeycomb kindergarten team all received
coherent training on teaching students how to read. We know a lot less about how
students become proficient writers, and thus the 3rd grade team was attempting to make sense of an incomplete knowledge base on which they had not been fully trained.

In short, in this study data-inquiry did not appear to be the knowledge-generating panacea some policy makers hope it will be. And yet, it did prove to be a successful intervention to help teachers make sense of knowledge in their repertoire in order to learn about their students and strategically deploy their instruction. Paired with other knowledge generating activities, data-inquiry may be a promising strategy to produce growth in students.
Chapter 3: What do we do now? How teachers collaboratively plan instruction in response to data

Abstract

Data-driven inquiry initiatives have become a popular form of teacher collaboration in U.S. K-12 schools. Many argue that such initiatives facilitate teachers using data to improve instruction and, in turn, student outcomes. Yet studies examining the impact of such data-driven inquiry interventions are decidedly mixed, raising questions about how, if at all, teachers adjust their instruction in response to data. To address this, this study follows three grade level teacher teams engaged in data inquiry in order to understand the individual and shared cognitive processes through which teachers design instructional responses to student-learning challenges identified in data. I find that one team was able to deploy instructional responses that addressed the learning gaps noticed in data. This team also had a wealth of instructional knowledge and centered their conversations on classroom practice. Conversely, the two other teams lacked instructional knowledge and focused their conversations around curriculum materials. These two teams were unable to generate instructional responses that clearly addressed the student-learning challenges they noticed in data. Despite attempts to generate a shared instructional response to data in team meetings, all the teachers in this study made individual decisions about which instructional routines to transport into their classroom practice.

Introduction

Reform efforts in U.S. K-12 schools increasingly rely on the use of data to inform instruction (Jennings, 2012). Such data-driven improvement strategies typically require
teachers to plan instruction in response to data on student learning. Many argue that with knowledge of student learning from data, teachers will be able to adjust their instruction to target the unique needs of their students (Bambrick-Santoyo, 2010; Goldring & Berend, 2008). In this manner, policy makers and school leaders argue that data-driven instruction supports both student and teacher learning and thus can drive improvement efforts and organizational learning in schools (Goldring & Berends, 2008).

Although such interventions have become popular among U.S policy-makers and in K - 12 schools, the empirical evidence on such programs is inconclusive. While some correlational studies show a positive relationship between teacher collaboration around student data and student achievement (Ronfeldt, Farmer, McQueen, & Grissom, 2015), causal studies of such data-driven initiatives have consistently found no effect on student learning (Quint, Sepanik, & Smith, 2008; West, Morton, Herlihey, 2016). At the same time, other studies have identified teacher teams that are effective at using student data to improve teaching and learning (Gallimore, Emerling, Saunders & Goldenberg, 2009; Timperley, 2009). Given all the policy support for data-driven instructional interventions, what might explain the mixed results?

To understand such differences, we must examine what teachers actually do when planning instructional responses to data and how they enact such instruction in their classroom (Little, 2012). In particular, research has yet to examine the individual and shared cognitive processes through which teachers make sense of and enact instruction in response to student-learning challenges noticed in data. Such an examination is important
because how teachers make sense of data-driven instructional initiatives underpins the success or failure of such policies (Spillane, Reiser, & Reimer, 2002), and may explain the variability of enactment observed in schools. As such this research aims to unpack the cognitive processes by which teachers plan instruction in response to student data by directly observing the processes.

**Literature Review**

Qualitative scholars who study teacher data teams often observe teachers using data to determine what content to reteach and to whom. Goertz, Oláh & Riggan (2009) examined teachers’ use of interim assessment data in nine elementary schools. They were particularly interested in what teachers learn from interim assessment data and how that shapes instructional decisions (Goertz et al., 2009). Based largely on interviews and surveys, Goertz et al. (2009) found that teachers predominantly used data reports to decide what content needed to be retaught and to whom. Furthermore, re-grouping was the most common instructional response, the effect of which varied based on the presence of instructional support staff (Goertz et al., 2009). Finally, most instructional responses were procedural in nature, with few teachers using data to plan new instructional approaches (Goertz et al., 2009).

Similar studies suggest teachers primarily employ re-grouping strategies in response to data as opposed to more substantive instructional adjustments (e.g. experiment with new pedagogies). For instance, Sherer & Spillane (2011) conducted a longitudinal case study of one school implementing a five-week assessment cycle. They
used interviews and artifacts to examine how the new data routine changed the work of the school (Sherer & Spillane, 2011). They found that the assessment cycle had a noticeable impact on school culture: the routine focused teachers’ and leaders’ communication around teaching and learning and gave leaders an entry point into classrooms. Yet only a modest majority of teachers reported adjusting their instruction in response to the data (62%), and such adjustments were mostly re-grouping strategies (Sherer & Spillane, 2011). Riggan & Oláh (2011) found similar results in their study of formative assessment use among 32 teachers in 2 districts. Relying on interview and survey data, they also found that teachers used assessment data to determine which students were struggling and which content areas were the lowest performing. Again, the reported instructional responses were largely re-grouping strategies (Riggans & Oláh, 2011).

At the same time, other studies find great variability in how teams enact the same data-driven instructional initiatives, with some able to improve instruction and student learning, while others reinforce the instructional status quo. Indeed, Timperley (2009) described data conversations among teaching teams in 7 low-income schools in New Zealand. All the schools experienced the same literacy professional development and were encouraged to meet throughout the school year to discuss any issues that arose. Even though the schools implemented the literacy program with equal fidelity, some schools saw achievement gains in reading while others did not (Timperley, 2009). The researchers attributed such variability in achievement to differences in the conversations teachers had using data (Timperley, 2009). In schools that saw greater gains in student
achievement, data conversations were imbued with a sense of urgency, teachers triangulated across data sources in order to diagnose student-learning problems, and teachers drew connections between student data and teaching practice (Timperley, 2009). In schools that saw fewer gains in student achievement, teachers privileged professional autonomy over collaboration (Timperley, 2008). Such variability in the enactment of the same interventions suggests that teachers’ individual and collective sense-making shapes the potential impact such initiatives can have on teaching and learning. Examining the role cognition plays in explaining such differences is at the heart of this study.

How is it that, with the same support and district context, teacher teams engage in data inquiry so differently? This research aims to closely examine teachers’ discourse around instructional planning and the enactment of data-based instructional decisions to understand the individual and team-level cognitive processes that support or inhibit data-driven initiatives. Understanding how teachers use data to shape instruction will allow school leaders and policy makers to better design and use data-inquiry initiatives as well as support teachers engaged in the work.

**Theoretical Framework**

Many data-driven instructional initiatives promote collaboration among teachers about student data and instruction as a stimulus for instructional improvement. But how do teachers’ prior knowledge and interactions with one another shape this process? This review draws on decades of research on how humans’ cognitive and social processes
shape policy implementation as this may illuminate why we observe such variation in the enactment of data-driven initiatives.

A preponderance of evidence suggests that teachers interpret policies calling for instructional change through the lens of their current beliefs and knowledge about teaching and learning (Coburn, 2001; Cohen & Ball, 1990; Putnam & Borko 1997; Spillanne & Thompson, 1997; Spillanne, 1999; Spillane, Reiser, & Reimer, 2002). Rather than embrace change, teachers tend to interpret new ideas about teaching and learning in a manner that aligns with their current practice (Coburn, 2001; Cohen & Ball, 1990). As a result, without sufficient knowledge about the underlying principles of reform, most instructional changes in response to reform efforts are superficial (Coburn, 2001; Spillanne & Thompson, 1997; Spillanne 1999).

Similar to how teachers respond to reform pressures, teachers’ beliefs and knowledge will likely shape how they plan instruction in response to data (Cohen & Ball, 1990; Mandinach & Gummer, 2016). Teacher’s current knowledge of content standards, beliefs about data use, and current instructional repertoire are all likely to play a role as teachers determine instructional responses to data and are more likely to undermine rather than support the intent of data-driven inquiry policies (Spillane, Reiser, & Reimer, 2002). Indeed, others have shown that a lack of instructional knowledge, in particular, can become an obstacle as teachers consider how best to respond to weaknesses noticed in student data (Timperley, 2009; Young & Kim, 2010). For example, teachers may plan instructional responses to data in a manner that draws on their current instructional
practice (Cohen & Ball, 1990; Coburn, 2001), rather than seeking new pedagogical solutions to student-learning challenges or privilege ideas from colleagues that affirm, rather than challenge, their current practice. In these ways, teachers may engage in data-driven inquiry in a manner that reinforces rather than develops their current instructional practice.

At the same time, scholars observe that such knowledge and beliefs are shaped over time by interactions with others (Coburn, 2001; Putnam & Borko 1997; Spillane, Reiser, & Reimer, 2002; Spillane, 1999). From this perspective, “knowledge is embedded in context”, or rather, teachers’ mental models for understanding initiatives are shaped by the social context, cultural norms, and dominant beliefs and knowledge in their school community (Spillane, Reiser, & Reimer, 2002, p. 404). Many argue that the social context a teacher experiences as she makes sense of policy initiatives can be the catalyst for learning and instructional change (Coburn, 2001; Spillane, 1999; Spillane, Reiser, & Reimer, 2002). Studies examining embedded learning find that teachers need time to come to a shared understanding of new policies with their colleagues (Coburn 2001; Penuel, 2007; Spillane, 1999). Such shared meaning-making is most effective when teachers engage in iterative, reflective and detailed dialogue about attempts to change instruction (Coburn, 2001; Spillane, 1999) in an environment typified by high levels of relational trust (Bryk & Schneider, 2002). In this manner, learning is a collaborative process—teachers may learn by following another colleagues’ example or by grappling with colleagues’ divergent viewpoints (Putnam & Borko 1997; Spillane &Thompson, 1997). Not all groups, however, foster learning: teachers’ whose knowledge and beliefs
are too similar or who lack access to new pedagogical knowledge often fail to surface assumptions would lead to questioning or adjusting current practice (Coburn, 2001; Hill, 2001; Spillane & Zeuli, 1999) and teacher groups that lack relational trust are less likely to take the risks inherent in attempts to change instruction (Bryk & Schneider, 2002).

Thus, patterns of individual and social cognition, and the interaction between them, may explain why some teacher groups adjust instruction in response to data while others do not. Teams that use data to shape instruction are likely to be comprised of teachers with access to a wide range of instructional knowledge related to their area of inquiry and have productive patterns of discourse around instruction that facilitate teachers learning from one another. These teams likely possess high levels of relational trust that supports risk taking. Such an environment will facilitate teachers embracing other’s instructional ideas and valuing deliberation before action—behaviors that are likely to foster the kind of iterative, reflective problem solving among teachers thought to promote instructional change. Such a context will also enable teams to consider multiple instructional responses to data, iterating between data and teaching to draw clear connections between the two in order to refine their instructional response.

In contrast, other teams may lack the requisite knowledge of teaching and learning or relational trust to engage in iterative problem solving. These teams are likely to value individual autonomy over shared sense-making, and, as a result, are likely to engage in minimal discussions about instructional responses to student-learning challenges. Rather instructional responses will be chosen amongst the teachers’ current
repertoire. In this manner, it is unlikely that data-driven initiatives will be a fertile environment for teacher learning and instructional change.

In this study, I apply a cognitive framework to closely examine how teachers collaboratively engage in a data-driven inquiry initiative. As described above, I contend differences in patterns of cognition may explain why and how some teams are able to use data to shape instruction, while others use data to validate current instructional practices. In order to guide this inquiry, I ask the following question:

*How do different teacher teams design instructional responses to student learning problems identified from data? How are such instructional choices shaped by teachers’ prior beliefs, knowledge and interactions with each other?*

**Methods**

I used a comparative case study approach for two reasons: 1) it allowed me to carefully examine, describe and compare the processes by which multiple teacher teams plan and enact instruction in response to data; and 2) such comparisons allowed me to explore how teacher teams adjust instruction in response to data and why some teams are more able to leverage data-driven inquiry initiatives to shape instruction compared to others.

**Sample**
My analysis focused on three teams of teachers located in one urban district, Chester Public Schools\(^2\) (CPS). CPS serves approximately 55,000 students, 20% of which are classified as student with disabilities, 29% English Language Learners and 49% as economically disadvantaged. CPS has a reputation (Huberman, Miles & Saldana, 2013) for successful school reform and robust data-driven inquiry initiatives. This study is concerned with what distinguishes teams that use the data-inquiry cycle to substantial adjust their instruction from those that maintain their instructional status quo. As such, I did not recruit teams that lack the basic organizational and leadership supports to proficiently engage in data-inquiry. Rather, by comparing more effective teams to more typically-performing teams, I surface salient differences in the cognitive aspects of designing instruction in response to data.

I purposively sampled teacher teams from the group of schools working with the CPS Inquiry Facilitators. As the CPS Inquiry Facilitators work closely with all the teams, I recruited teams for the study from their recommendations (Huberman, Miles & Saldana, 2013). At my request, the facilitators recommended teams they believed were either ‘data-shapers’ or more ‘data-validators’. By ‘data-shaper’, I mean to indicate teams that use data to shape instruction, while ‘data-validator’ teams use data to validate existing instructional methods. While multiple CPS Inquiry Facilitators recommended teams, I purposively sampled teacher teams from the group of schools working with one CPS Inquiry Facilitator. By limiting the sample population to teacher teams who work with the same CPS Inquiry Facilitator, I ensured that teams used the same data-driven inquiry

\(^2\) All names—districts, schools, participants—are pseudonyms.
framework and received comparable levels of support. Furthermore, as part of the application process for Inquiry Facilitator support, schools demonstrated their organizational ‘readiness’ to implement data inquiry, including strong principal leadership, teacher buy-in and dedicated meeting time for teachers. Thus, by sampling only from this group, I increased the likelihood that teacher teams experienced similar levels of leadership and organizational supports within their schools.

The inquiry facilitator described one of the teams sampled as a ‘data-shaper’ (Honeycomb kindergarten team) and the other two teams as ‘data-validators’ (Honeycomb pre-k and Oreville 3rd grade team). Two teams in the study, a Kindergarten team and a pre-Kindergarten team, work in the same early childhood center, Honeycomb School, which serves students in pre-K through 1st grade. The last team is a 3rd grade team located in a K-8 school, Oreville School. With one exception, all classroom teachers in all groups were female, though their race, age, and teaching experience varied. See Table 1 below for team composition data.

Table 1: Selected Teacher Characteristics

<table>
<thead>
<tr>
<th>Role</th>
<th>Gender</th>
<th>Race</th>
<th>Years Teaching</th>
<th>Years at this school</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kindergarten, Honeycomb School</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abigail Classroom teacher, K Inclusion, Team leader</td>
<td>F</td>
<td>White</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Jessica Classroom teacher</td>
<td>F</td>
<td></td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Name</td>
<td>Position</td>
<td>Gender</td>
<td>Age</td>
<td>Seniority</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------------</td>
<td>--------</td>
<td>-----</td>
<td>-----------</td>
</tr>
<tr>
<td>Lila</td>
<td>Classroom teacher, K ESL</td>
<td>F</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Cape Verdean, African American</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Karmen</td>
<td>Classroom teacher</td>
<td>F</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Cape Verdean, African American</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sean</td>
<td>Reading Specialist</td>
<td>M</td>
<td>27</td>
<td>15</td>
</tr>
</tbody>
</table>

**Pre-Kindergarten, Honeycomb School**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Gender</th>
<th>Age</th>
<th>Seniority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Libby</td>
<td>Classroom teacher, K0 inclusion, team leader</td>
<td>F</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miranda</td>
<td>Classroom teacher, K1 Inclusion</td>
<td>F</td>
<td>26</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isadora</td>
<td>Classroom teacher, K1 ESL</td>
<td>F</td>
<td>28</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Cape Verdean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aaron</td>
<td>Classroom teacher, K0 Bilingual</td>
<td>M</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**3rd Grade, Oreville School**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Gender</th>
<th>Age</th>
<th>Seniority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jasmine</td>
<td>Classroom teacher, Team leader</td>
<td>F</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Karen</td>
<td>Classroom teacher</td>
<td>F</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marigold</td>
<td>Classroom teacher</td>
<td>F</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CPS promotes a model of data inquiry described by the Data Wise Project at Harvard University. The Data Wise Improvement Process is an 8-step cycle with three overarching phases. In the prepare phase, teachers develop collaborative structures and build their understanding of relevant standards and assessments. In the inquiry phase, teachers examine multiple data sources, identify a student-learning challenge, observe instruction, and discuss instructional weaknesses in order to identify what is lacking in their instruction related to the student-learning challenge. Finally, in the act phase, the team determines an instructional response and makes a plan for how they will enact the response and assess progress (see Figure 1 for an outline of the process). Under ideal circumstances, through the Data Wise process teacher not only meet student learning needs noticed in data, but also learn new instructional strategies previously unknown to the team (Boudett & Murnane, 2013). In this manner, Data Wise, when implemented well, supports the sustained, detailed and reflective collaborative inquiry thought to promote instructional improvement. In this study, I explore what teachers do after they have analyzed student data. Namely, how do they examine their own instruction and determine how to adjust their practice in response to student-learning challenges noted in data. I have worked as an instructor, consultant, and course designer with the Data Wise Project for 4 years. As such, I have a deep understanding of the Data Wise cycle, but also carry potential bias about the program based on my own work.
Data

Qualitative data was collected in three ways: interviews with teachers, observation of teacher team inquiry cycle meetings, and observations of classroom instruction followed by post-observation interviews. All meetings were audio-recorded and I took field notes. Data collection spanned 6 months from January 2017 to June 2017. In this time period the two Honeycomb School teams completed two inquiry cycles and the Oreville team completed one inquiry cycle. At Honeycomb, teacher team meetings occurred weekly; at Oreville meetings were biweekly. In total, I observed 12 Honeycomb kindergarten team meetings, 13 Honeycomb pre-K team meetings, and eight Oreville 3rd grade team meetings. For the purpose of this study, I analyzed data from one inquiry cycle for each team. Thus, I transcribed only a portion of the team meetings observed—six kindergarten meetings, eight pre-k meetings, and six 3rd grade meetings.
In the first interview, teachers were asked about their professional background, beliefs about teaching, learning, and data inquiry, knowledge of instruction and students, and prior experience working collaboratively with colleagues. At the end of the study, teachers were interviewed to discern what and how they learned from colleagues through data inquiry. See details of interview protocols in Appendix A.

Observation of teacher team meetings provided evidence of how teams planned instructional responses to learning challenges noticed in data. I use the observations to describe teachers’ discussions of instruction and to link those discussions to instructional changes or preservation of existing practice. Observational data was also used to hypothesize what beliefs and knowledge teachers brought to bear in conversations about instruction with colleagues, what ideas got taken-up by the group, which got squelched, and the extent to which teacher discourse around data and instruction was iterative, reflective, and detailed. Observations of data meetings also provided evidence on how, if at all, disagreements amongst teachers and/or teachers modeling new ways of thinking promoted learning. In addition to examining the cognitive process at play, observational data was also used to confirm or dispute whether or not teams identified by CPS Inquiry Facilitators are indeed ‘data-shapers’ or ‘data-validators’.

Classroom instruction and the post-observation interview provided evidence of how teachers enacted instructional plans designed with their team. I asked teachers to invite me to their classroom when they were teaching a lesson related to the inquiry cycle. I observed each teacher once per inquiry cycle. I took literal notes when observing
classroom instruction. The classroom observation data informed the subsequent teacher interview and, because I only observed once per cycle, was not itself designed to detect changes in instruction. In these interviews, I read teachers literal notes from segments of instruction, then asked teachers to describe their thinking during the selected instructional moment and articulate what shaped their decisions. The data was analyzed to determine the extent to which their thinking was shaped by their prior beliefs and knowledge and/or the team’s inquiry cycle. The data also provided evidence of how teachers made individual meaning from group discussions and the extent to which their instructional choices were shaped by working with their colleagues.

**Analysis**

I employed a pattern matching strategy (Yin, 2013) to draw connections between individual and social cognitive processes and whether or not teams were data-shapers or data-validators. The analytic goal of pattern matching is to determine if the empirical patterns observed in the data are consistent with the hypotheses about the relationship between cognitive processes and data-inquiry team performance presented earlier (Yin, 2013). Both individual teachers and teacher teams were treated as cases and cases were coded sequentially (Miles, Huberman & Saldaña, 2013). Throughout the process, I avoided using the Data Wise framework and associated terminology in order to protect against potential bias. Rather, I simply used descriptive language and avoided evaluating teams against the Data Wise framework.
In order to understand how individual cognitive processes shaped how teachers designed instruction in response to data, I treated each teacher as a case. In the first iteration, interviews and observations were coded to describe how each teacher draws on prior beliefs and knowledge when determining an instructional response to data. This round of coding used a set of provisional codes suggested by the literature, initial field notes and/or the research questions. For each teacher/case, I wrote a memo after the first round of coding, identifying tentative patterns of how this particular teacher draws on prior beliefs and knowledge when determining an instructional response to data. In the second round of coding, I looked across teachers within a team to look for patterns of individual cognition that shaped how the team planned instruction, again writing memos describing the individual cognitive processes that shaped each team’s instructional planning. Finally, I looked across teams in order to compare and contrast patterns noted within teams. I draw primarily from this cross-team analysis in reporting the results below. Such comparative analysis allowed me to distinguish how patterns of individual cognition varied across teams. To do so, I organized the patterns from the two sets of memos into a matrix (Miles, Huberman & Saldaña, 2013), with each row representing a teacher/case and columns representing patterns of cognition and patterns of instructional planning within each case. I iterated between writing memos to synthesize patterns within and across cases and re-analyzing the data to look for evidence that confirmed or refuted the tentative claims in the memos. An analogous approach was used to understand how situated cognitive processes shape how teachers plan instruction in response to data.

Findings
How do different teacher teams design instructional responses to student learning problems identified from data?

During the data-inquiry process, all teams analyzed student data to determine a student-learning challenge. The process by which teachers made sense of data is described elsewhere in detail and will only be reviewed briefly in each case presented below (Barmore, unpublished manuscript). Here we explore what teachers do after data analysis, but before classroom instruction. Namely, how do teachers collaboratively plan to address the data-based student-learning challenge in the classroom? Ideally, though the Data Wise Improvement Process, teachers examine their own instruction and together learn a new instructional strategy to address the gaps noticed in student data. In what follows, I first present how two teams engaged in data inquiry cycle: the Honeycomb kindergarten team and the Oreville 3rd grade team. Then I present three themes that distinguished how these teams determined instructional responses to the student learning weaknesses noticed in data analysis phase, and also note one salient commonality between the two teams.

The first team, Honeycomb kindergarten, centered discussions on instructional routines, drew on their shared repertoire of guided reading instructional strategies, and regularly iterated between instructional responses and the gaps in student learning noticed in the data. While the team did brainstorm novel instructional approaches, ultimately each teacher made individual decisions about how to address the data-based student learning needs in the classroom. As a result, teachers’ instructional choices addressed their student
data, but few teachers learned new instructional strategies, thus falling short of the ideal execution of the Data Wise Improvement Process. The second team, Oreville 3rd grade, focused on the tasks embedded in their curriculum when determining how best to respond to the gaps in student learning noticed in the data, thus their conversations rarely attended to interactions between students and teachers in the classroom. While the team did explore a new instructional strategy, they lacked consensus on target student writing skills necessary to implement it in the classroom. Thus, their struggles with earlier steps in the Data Wise Improvement Process hindered their ability to action plan. Indeed, their lack of agreement about new writing expectations and instructional routines to teach writing more generally resulted in haphazard instructional responses to data. Ultimately, while all teachers drew on the myriad of general teaching strategies discussed as a team to teach writing in their classroom, most did not deploy instruction that clearly targeted the student learning needs identified when analyzing data.

**Targeted Instruction in Response to Data: The Honeycomb Kindergarten Team**

As described in Chapter 2, the Honeycomb kindergarten team engaged in strategic data analysis, characterized by a precise focus, methodical data collection, and evidenced-based discussions. When determining their student-learning challenge they triangulated across three data sources: running records, a ‘concepts about print’ assessment and a sight word inventory. They used the data to group students into three skill levels: red—below grade level; yellow—approaching grade level; green—at or above grade level. They analyzed the data to surface patterns of reading skills within each group in order to determine the three student learning gaps in table 2—one about
decoding words, another about 1-1 correspondence and the final about identifying sight words. Using data to determine weaknesses in the students’ reading skills was the starting point for determining an instructional response.

Table 2: Focus area and student-learning challenges for data inquiry teams

<table>
<thead>
<tr>
<th>Team</th>
<th>Honeycomb kindergarten</th>
<th>Oreville 3rd Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus Area</td>
<td>Multi-task Nature of Reading</td>
<td>Writing</td>
</tr>
<tr>
<td>Student-learning challenges</td>
<td>#1: Students are struggling to apply multiple reading strategies to decode unknown words. (‘Green’ Students)</td>
<td>While students understand that they need to use evidence in support of a claim to answer a text based prompt, they do not consistently answer the prompt completely, including explaining their thinking.</td>
</tr>
<tr>
<td></td>
<td>#2: Students are struggling to use 1:1 correspondence and read sight words. (‘Yellow’ students)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#3: Students are struggling with sight words and overall concepts of print. (‘Red’ students)</td>
<td></td>
</tr>
</tbody>
</table>

Before determining an instructional response to address the skills in table 1 and consistent with the expectations of Data Wise, the team observed each other teach during guided reading instruction in order to understand their instructional ‘status quo.’ By observing and discussing each other’s practice, teachers focused their subsequent conversations on the instructional routines for reading and attended to the interactions between teachers and students around content. For example, below we see the team share what they observed in each other’s classrooms:
Abigail: I noticed that the teacher gave verbal cues like 'remember to point to each word.'

Karmen: I noticed that the teacher went over sight words with the students.

Lila: I noticed that one teacher ... reminded the kids to use a reading strategy, lips to fish...

Jessica: A teacher had them sound out words.

Abigail: ...I noticed students were like manipulating sounds and letters within a word.

Jessica: I had pointing by each word.

In this exchange, we see teachers describing teacher actions (e.g. verbal cues), student behavior (e.g. manipulate sounds) and some shared instructional routines (e.g. the reading strategy lips to fish). Observing instruction focused their attention on the teacher’s instructional moves as well as how students engage with content—such observations laid the groundwork for a continued focus on instructional routines when they discussed how best to address the student reading needs noticed in data.

This focus on instruction continued as the team used their observations of each other to identify what might be lacking related to student weaknesses noted in the data report. For example, Karmen offers:

...Something that I noticed is that as teachers we're struggling with implementing similar strategies. So some of us are reading the book with our students and then having them reread it and then some of us are having the students read the book on their own... when you read the book with the students... they might not actually know what they're reading so you might not get the correct data that you're collecting when you're reading with them. But when they're doing it on their own you can see what they're individually doing.

Here we see Karmen highlight inconsistencies in guided reading strategies across classrooms—she attends to what teachers are doing as they teach (read book with
students) and what impact the instruction may have on students (they might not know what they are reading). Such discussions around instruction allowed teachers to agree on the following instructional shortcoming related to the student reading data:

> As teachers, we are not yet consistently teaching reading strategies that are clear and graspable for students to implement on their own when faced with an unknown word.

This focus on instruction permeated the Honeycomb team’s efforts to address their student data as they consistently attended to how teachers were interacting with students and how students were interacting with content. Indeed, they were able to maintain a focus on their instruction throughout their planning process when discussing how best to address the deficits in instruction related to their analysis of student data.

This degree of focus might relate to Honeycomb teachers’ strong background in guided reading instruction and students’ reading development. Indeed, two of the teachers, Abigail and Lila, earned their masters degrees as reading specialists and the school’s reading specialist, Sean, participated in team meetings. Teachers also had access to original research on reading; for instance, at the request of Lila, teachers brought books and articles to a team meeting and discussed them at length.

These books and articles helped teachers, in a subsequent meeting to brainstorm how best to respond to the student-learning challenges noticed in data. For example, below we see Lila share with the group what she learned from an article on comprehension:
...So it talked about how when kids are reading and they don't understand what they are reading it's just word working... the importance of how comprehension is built through shared reading, read-alouds, independent reading, guided reading and how there are specific strategies that you have to use to teach kids how to comprehend. And the importance of students reading level[led] text...

As Lila shares, she notes the difference between reading as recitation and reading to comprehend and highlights the importance of various instructional activities such as read-alouds. She then goes on to identify a new practice—sketch to stretch:

... It says they just sketch or doodle, not detailed. And then they share it with someone else. So, it's like an event, something that they learned, like if you were doing a non-fiction it is something that they learned... I thought that was a really good idea...like you read a story, will probably take like 15 minutes you know, they're just doodling. So, you can just really see what they are learning

Here we see Lila provide a description of sketch to stretch. As the discussion proceeded, and with similar amount of detail, Lila highlighted two more instructional strategies: clink and clunk and turn and talk after reading. Over the next 15 minutes, other teachers also shared instructional ideas from their readings. For example, Karmen, a first-year teacher, described how to incorporate reading strategies for decoding into a silent reading routine. Sean, the reading specialist, talked about how teachers need to respond in the moment to student reading challenges. Abigail offered a comment about the importance of students having opportunities to talk to each other about reading as well as using read alouds, shared reading, guided reading and independent reading. Jessica reminded the team about the need to model reading strategies and make students reading strategies explicit to them, so they can build self-awareness.
By the end of this meeting, the team had named and described an array of instructional routines targeting student reading and comprehension skills, though it was unclear how many new ideas were generated. Indeed, outside of sketch to stretch and clink and clunk, team members listed most strategies in the ‘affirmation’ column of their meeting notes, rather than in the “new learning” or “put into practice” section. This suggests the exercise served to reinforce knowledge they had previously learned rather than generate many new ideas (see table 3 for example of notes). At the close of the meeting, a few teachers acknowledged the paucity of new ideas, saying things like, “…for new learnings, there wasn't a ton of new information.”

Table 3: Excerpt from notes on Honeycomb K Team reading protocol

<table>
<thead>
<tr>
<th>Resource</th>
<th>A (Affirmation)</th>
<th>NL (New Learning)</th>
<th>PiP (Put into Practice)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research on Reading Comprehension</td>
<td>-When students are reading but not comprehending it is just word barking</td>
<td>7 different components of teaching comprehension</td>
<td>-draw to sketch</td>
</tr>
<tr>
<td></td>
<td>-Comprehension is built through shared reading, read aloud, independent</td>
<td></td>
<td>-take turns retelling the story with a buddy</td>
</tr>
<tr>
<td></td>
<td>reading, guided reading</td>
<td></td>
<td>-clink or clunk</td>
</tr>
<tr>
<td></td>
<td>-specific strategies that have to be taught</td>
<td></td>
<td>-sketch to stretch</td>
</tr>
<tr>
<td></td>
<td>-importance of students reading leveled text</td>
<td></td>
<td>-different center ideas-Puppets that they can retell a story</td>
</tr>
</tbody>
</table>

After brainstorming ideas from the readings, the Honeycomb kindergarten teachers worked to select an instructional response from all of those discussed. The team
leader, Abigail, is the first to suggest adopting a shared instructional strategy to address
the student needs noticed from data (see table 2) and the team’s related goal of teaching
specific strategies across classrooms:

So if we look at what we collected together, do we feel passionately about putting
out any one of these things into practice and using the rest of our time? We only
have nine minutes to co-plan either guided reading or read aloud lesson that will
implement one of these new approaches. I really like the idea of ... giving them
time to process the story on their own and giving them time to go back and sketch
it and giving them time to retell using their own words. Which ... was kind of a
theme ... amongst what everyone said ... So, what do we think would be more
meaningful to move forward?

Here Abigail attempted to move the teachers towards consensus on which ideas from the
brainstorm to implement. Notably, she advocated for using sketch to stretch, one of the
few new ideas the team generated. After a silent pause, Abigail continued:

… the skilled teacher of guided reading makes decisions… I think that we're
doing that with our flexible grouping, with our small groups. The questioning and
modeling the reading strategies that definitely relates to our [student-learning
challenge] directly when we say that we're trying to give them explicit strategies
to learn how to read. And then the next three little bullets from Lila, from her
article kind of go along with those strategies. And then the modeling bullet kind of
goes with the first [students struggling to decode unknown words]. So why don't
we try to plan a lesson together that's going to incorporate one of these activities
that Lila wrote about?

Here we see Abigail start to iterate between the approaches the team has brainstormed
from the readings and the student weaknesses noticed in data analysis. She named what
the team is already doing—questioning and modeling reading strategies—and then
advocated for incorporating one of the ideas Lila shared—sketch to stretch or clink and
clunk. Uncharacteristic of the group, Abigail’s suggestion was initially met with silence.
It may be that they were overwhelmed by choices or that the facilitator felt the pressure of time with only nine remaining minutes in the meeting.

In the remaining minutes of the meeting, teachers attended to the relationship between their proposed instructional responses and the learning gaps noted in the student data. For example, a few moments after Abigail suggested incorporating sketch to stretch in their instruction, Jessica and Lila expressed concern that the instructional strategy addressed comprehension and not the gaps in learning noticed in the data, which are about decoding words, 1:1 correspondence and sight words. After Lila expressed this, Jessica supported her and said,

*Correct me if I am wrong, but I think the [gaps in student reading skills] ... are more strategy skills. While a lot of what we have found [in the articles] ... revolves around comprehension...And so I feel like it is determining if we want to look at how students comprehend and focus on their comprehension skills and their ability to retell which is going ... to be an important part. Or whether we want to focus more on the foundational piece.*

Jessica’s comment turned the team’s attention away from the new instructional ideas towards focusing on instructional routines that better match the learning gaps the team noticed in data. While the team considered a new instructional strategy, they soon discarded it as it did not address their students’ learning needs. Notably, the team did not attend to any of the instructional shortcomings they noticed in the prior meeting, but solely the student learning gaps they noticed in the data. As the meeting ended, without clear consensus on what to do next, it was unclear how teachers would respond to student data in their classroom.
During my observation of instruction after these meetings, all teachers addressed at least one of the student-learning challenges in table 2. For example, Lila, Abigail and Jessica all coached students to point along with books as they read, a strategy to help students develop one-one correspondence. Likewise, all the teachers previewed the sight words students would encounter in the book. Finally, both Lila and Karmen coached students to use pictures to decode unknown words. Indeed, in post-observation interviews, each teacher articulated how the analysis of the student data shaped their instructional decisions. For example, after her observation, Lila reported:

*I think the thing with my team meetings [is that] we're always testing them. So, I feel like it always helps my instruction. Because it always keeps me informed on where they are.*

Jessica expressed a similar appreciation for the student data and described how her instruction matched one of the reading weaknesses the team noticed in the data, namely one-one correspondence. For example, when asked to describe how she ran one of her reading groups, she responded:

*They're still working on their one-to-one correspondence... And a part of it is making sure that they're pointing to the correct words as they're reading... Right now, I just have them point and I tell them that tells your eyes where to look so your eyes have to be looking at the word that your finger is pointing to... sometimes what I've noticed is that some of them also get ahead of themselves. And so, they'll read but they'll skip along.... So, I'll tell them “OK let's point” and then when they make a mistake I say “OK let's go back, let's point to that and read each word and see.”*

Above, we see Jessica articulate the teaching moves she made to help students build their 1-1 correspondence skills, thus it is clear she responded to the data in her classroom. However, what she described—coaching students to point at words and observing to ensure they do—was not a teaching move discussed explicitly at the meetings. Indeed,
Jessica was unable to name any instructional approaches she brought to the classroom from the meetings.

Observations and post-observation interviews with teachers suggested, in fact, that they made individual decisions about what strategies to implement in their classrooms, some of which were influenced by the team brainstorm and others of which were not. Karmen, a first-year teacher, appeared to make the most use of the team’s discussions of instruction. After I observed her conduct a guided reading group she described how her instruction was shaped by her work with her colleagues:

…. [inquiry meetings] gets you into the process of analyzing what you’re doing in your classroom. How are you teaching the students? Are you teaching for comprehension? I remember we did an inquiry cycle … I think Susan brought in articles on comprehension. And that got me thinking … adding that piece where they get to connect with each other. Talk about the story. Things like that stem from what we do during our meetings.

Indeed, in Karmen’s class, I observed her engage students in turn and talk with each other after silently reading a book, an instructional idea that was generated at the team meeting.

In contrast, while the inquiry group work influenced how Abigail approaches guided reading generally, she was unable to describe how the discussions about instructional strategies from this particular inquiry cycle had informed her instructional choices. When asked how inquiry work has influenced her instructional decisions, she reports:

Not so much this year, but last year it was a really big. A really big switch to being… very intentional with the instruction and really individualizing it for what the groups need… I don’t know that this cycle has changed anything I did.
Though many of the strategies the team discussed were present in Abigail’s classroom—students are reading independently, previewing sight words, and encouraging students to use a pointer as they read—they were not new to her, thus while the teams’ work may have reminded her of the importance of these strategies, it is possible she would have implemented them regardless off the team’s discussion. Similarly, though Lila made use of the data analysis of the meetings, she also expressed frustration that the team didn’t talk deeply about instruction. As such, she didn’t feel she got many useful instructional ideas from their work together.

**Missing the Target: The Oreville 3rd Grade Team**

Throughout data analysis, the Oreville team struggled to precisely define the writing skills they wanted to examine. As a result, their collection of data was haphazard, with teachers often collecting readily available examples of student writing rather than ones chosen with a specific intent. Likewise, their analysis of student work was also unfocused; teachers’ observations spanned a wide range of writing skills and often appeared based on their impressions rather than a clear evidence-based examination of the data. Nonetheless, the team did come to an agreement on a weakness in student writing they wanted to address in the classroom. The team had noticed that when answering text-based prompts, while students were able to draw on evidence from the text in their answer, they often did not respond completely to the prompt nor consistently explain how the evidence they cited addressed the question. They codified this weakness in student writing as the following: *While students understand that they need to use*
evidence in support of a claim to answer a text-based prompt, they do not consistently answer the prompt completely, including explaining their thinking.

Before determining an instructional response to the student writing weakness noted in the data analysis phase of the inquiry cycle, the Oreville 3rd grade team analyzed their curriculum—Expeditionary Learning ELA—to identify potential gaps or shortcomings in the curriculum related to their student learning concern. This was a departure from the Data Wise Improvement Process which encourages teachers to directly observe instruction and this also stood in stark contrast to the Honeycomb team, who examined their classroom instruction. Because the Oreville team focused on curriculum, their discussions centered on reviewing the lesson activities and the writing tasks embedded in the materials instead of focusing on teachers’ instructional delivery or students’ engagement with the content. During this process, teachers expressed concern that the ELA curriculum did not ask students to write frequently enough and that the writing tasks lacked the rigor they observed on the district interim assessments and state tests. This gap in expectations motivated the team to identify a shortcoming in the curriculum related to their concern about student writing that was about giving students more writing opportunities:

As teachers, we need to give students more opportunities to apply the thinking and skills on culminating assessments throughout the unit (i.e., synthesis).

Notice this problem is largely about what kind of writing tasks they assign and not about instructional strategies to teach writing in their classrooms. This stood in contrast to the Honeycomb kindergarten team, whose conversations about responding to data revolved around weaknesses their instructional practice, not their curriculum.
Thus, while the Honeycomb teams’ focus on instruction led them to discuss instructional routines, the Oreville teams’ focus on curriculum led teachers to discuss creating new writing opportunities within the structure of their curriculum. However, such attempts often fell flat; teachers reviewed writing assignments in the curriculum without making substantial changes. For example, over the course of several meetings, teachers discussed a letter each student wrote to the author of the book series they had been reading. They discussed how to break students into groups, identified the need to model writing skills, and planned when to teach which lessons. While these discussions may have been important for planning purposes, they served to reiterate activities already present in the curriculum and did not address how they would teach students to fully answer text-based prompts and explain their thinking, the concern the team had noticed in student data. Furthermore, at several junctures, the principal and district inquiry facilitator raised questions about the rigor of the assignment, yet these questions went unresolved. In the end, very little was changed about the assignment from the previous year. Thus, while the team hoped that working within the framework of their curriculum would make their workload more manageable, in the end it crowded out other activities such as creative problem-solving or a specific focus on the student learning challenge and resulted in teachers defaulting to the activities and tasks in the curriculum.

The team’s efforts to address their concerns about student responses to text-based prompts was also hampered by their struggle to come to consensus on exactly what writing skills were embedded in their student-learning challenge, and, consequently, the
relationship between those skills and the Common Core Standards. Indeed, they focused their inquiry on writing in hopes of deepening their understanding of the standards. Yet, this lack of consensus hindered their ability to design an instructional response that clearly addressed their concerns about student writing deficits. While they made several attempts to gain clarity—by analyzing exemplar writing responses and reviewing several writing rubrics—these discussions rarely resulted in codifying clear sets of target writing skills.

Ultimately, this lack of clarity on their target writing skills caused the team to lose sight of their original concern—students were not fully answering text-based prompts or explaining their thinking—and the team began to discuss how to teach writing more generally. As a result, their discussions about instruction jumped from one idea to another without clearly settling on a coherent response to the student data. For example, the team discussed the need for rubrics, graphic organizers, peer editing, nightly journals and anchor charts to support students’ writing, but did not discuss any of these ideas in depth.

The lack of clear target skills also appeared related to the team’s inability to settle on an instructional response to their student-learning challenge. For example, in one meeting the Data Inquiry Facilitator introduced a new instructional technique called Show Call, a routine where a teacher displays student work for the class and then explicitly shows how the student’s work meets the criteria for the assignment. While the team was interested in trying Show Call, the routine requires well-defined criteria for success, something the team had been unable to agree upon. Karen noticed this, saying:
Karen: So, we’ve been working on something that proficient writers do, that have a checklist for it. We use that for the social studies, right. Is that what we're using as our criteria?

Jasmine: So, I want you to put that over here. (motions for Karen to put comment in parking lot).

Karen: I know but I’m just wondering has she mentioned the criteria for success? I want to know what our criteria for success is.

Jasmine: nope, nope, nope.

In response to Karen, Jasmine, the team leader, put getting clarity on criteria ‘on hold’ twice. Jasmine wanted the team to focus on learning the instructional routine and not be distracted by their lack of consensus on the criteria for success. Yet, as Marigold notes a few moments later, the teachers can’t use Show Call without clarity on the target skills:

I think in what Karen said... we just kind of need the check list in the back of our mind cause I think that helps us as teachers make teachers moves, to help them make writers moves. So, like I understand where the checklist might come in as far as like what are we doing. I know we're tabling it for right now, but that it does need to be discussed at some point...

This was typical of the 3rd grade teams’ work: a lack of clarity on the target writing skills was an impediment to determining and appropriate instructional response. Simply put: teachers could not employ any of the instructional strategies named effectively if they did not know what they were in service of.

As teachers lost sight of the original writing concern and failed to codify target writing skills more generally, the curricular adjustments and instructional responses to student writing became unmoored. Such challenges were compounded by the team’s choice to limit themselves to looking for opportunities within their curriculum, as this
narrowed the possible ways they might address student writing weaknesses. For example, the team discussed a recurring task with every chapter of their current ELA unit: identifying where a story takes place, who the characters are, and what the important events are. Below the team discussed how to use this task to address their concern that students are not fully answering text-based prompts.

Karen: ... Because one of the things that we've discovered is that they're not making a nice claim and using transition words.

... Jasmine: But for every chapter, what would they write? Because that's just writing key details and important events.

Principal: What would the claim be that they...

... Jasmine: That's what I'm saying. So, this task has nothing to do with writing about reading really because it's not as specific as what you're saying.

Karen: Can we make it be more specific?

Jasmine: Well that's what you're saying. I think that's what you're saying... I think that's a great point.

Karen: It may not be for every chapter cause that is a lot. And then they come away every week... Or every night with one of these or every day, I feel like is a lot.

In this exchange, the team considered how they might use a writing task in the curriculum to address weaknesses in student writing. Karen promoted this idea, while Jasmine and the principal expressed concern that the task may be too simple, as it does not ask students to make a claim or synthesize, but simply to recall information. While the team considered adjusting the task, they ultimately never identified how they might change the prompt to give students more complex writing tasks. Instead Karen began to attend to how frequently to assign the task. This was a typical discussion of the curriculum tasks: teachers would review the task, realize it did not meet their goals, fail to substantially
adjust the task and turn their attention to planning logistics. Thus, by focusing on their curriculum, teachers’ attention was repeatedly drawn to instructional tasks that did not address the various writing skills they had discussed. As a result, teachers often lost focus on the student need they were originally trying to address, specifically students’ ability to consistently answer the prompt completely and explain their thinking, and instead attended to logistical aspects of curriculum implementation (e.g. how frequently to write journal).

In addition to discussing the tasks embedded in the curriculum, teachers also briefly named broad instructional routines when planning curriculum, though these discussions rarely attended to the details of enacting the instructional strategy in the classroom. For example, below the team discussed how to structure the end of unit research papers on culture:

*Margiold: Because a lot of the stuff we are talking about now, remember in expert groups, we're going to be doing like scaffolding and co-writing with them and creating anchor charts for them to refer back to. But then it's the final thing that this is on their own.*

*...*

*Susan (Data Inquiry Facilitator): Right. And the expert groups in social studies is that leading up to a whole class research paper?*

*Marigold: Yes. It seems like they're all going to write a paragraph about whatever that topic was. If it was daily living, a school life or a discipline. ... So ... each one was going to make a poster and part of the poster was going to be a paragraph and some other things.*

*Karen: I think it was going to be research and a paragraph, as we teach them how to do leads, as we teach them how to do punctuation, transition words.*
Above we see teachers attended to the logistics of the end of unit assignment: they focused on how students will be broken into expert groups and clarified how each expert groups’ paragraph will come together to form a full research paper. Within this discussion, both teachers also briefly named instructional routines to teach students how to write: scaffolds, co-writing, teaching leads, punctuation and transition words. This was typical of how the Oreville team discussed instruction—they named routines without discussing how to enact the strategies. Thus, teachers were left on their own to interpret what a given routine entailed.

Not surprisingly, classroom observations suggested wide variation in instructional practice between classrooms on the Oreville team. While lessons contained at least one broad instructional idea discussed at team meetings, only Marigold’s lesson attended to the writing skills they had explored. For example, Karen was observed facilitating a peer editing process in her classroom, an idea she reported was inspired by Marigold during an inquiry meeting. Yet instead of drawing upon the criteria for writing the team had been discussing to guide the peer editing process, she used a peer editing worksheet she found online that asks students to give compliments and suggestions—a vague prompt that did not target the skills related to the inquiry cycle. A similar disconnect was observed in Jasmine’s and Malia’s classrooms – they used instructional routines mentioned in the inquiry meetings, namely, revising and editing—but they did not target the writing skills that had been discussed. Rather Malia focused on the use of adjectives and Jasmine focused on writing conventions using a rainbow editing activity she found on Pinterest. Only in Marigold’s classroom did I observe a teacher engage students in revising and
editing their writing specifically focused on the writing criteria discussed in the inquiry meetings.

Indeed, when asked how the team’s inquiry cycle has shaped their classroom practice, each teacher reported very different take-aways, not all of which appear connected to the salient themes of their team meetings. For example, Karen talked about emphasizing writing basics, saying, inquiry has, “…made us more aware that we've dropped some of the … basic things in writing that worked …like grammar skills and conventions”, yet the team never discussed grammar weaknesses when analyzing student work. Meanwhile Malia reported focusing on narrative writing as a result of inquiry meetings, though she targets her instruction on the use of adjectives in narrative writing, a skill never discussed in the meetings. Jessica is less optimistic, at first saying that inquiry did not influence her observed lesson and then revising by saying:

…I think the inquiry it's important because I think we need to focus on writing and we talked about how we can be better writer teachers…. the way that we need to do that is teaching them about editing and teach them about revising.

Marigold’s lesson and reflection stood apart from the rest of the team as her lesson explicitly focused on the writing criteria the team had been discussing in the inquiry meetings. She reports:

I think we’ve just been doing so much work in regard to writing that it's made me very aware … of writing and then really making sure that I’m understanding what is the criteria before I teach it because then that gives me a clearer perception of what I want to highlight and teach.
Thus, we can see that while each teacher reported bringing some piece of knowledge from the inquiry meetings into their classroom, it is only Marigold who seems to have internalized some of the salient themes of the inquiry meetings.

**What shapes teams’ instructional responses to data?**

Above, we see the Honeycomb team was able to use knowledge they gained from student data to shape their instructional decisions—though teachers were ultimately unable to collaboratively learn new instructional approaches, they were able to enact instruction that targeted the students’ needs found in data. On the other hand, the Oreville team struggled mightily to use data to shape their instructional decisions—while teachers enacted a variety of instructional approaches discussed at team meetings, only one seemed to clearly attend to the patterns noticed in student data. Below I explore differences in the teams’ individual and social cognitive patterns that may help us understand why one team was more able to use data to shape instruction than another.

An initial step in this analysis constituted comparing the Honeycomb kindergarten, Oreville 3rd grade and the Honeycomb pre-K to isolate differences in the individual and social processes that could underlie these very different outcomes. In doing so, I drew up a list of potential factors, some linked to the literature and some emergent from observations and interviews themselves. I summarized how these factors differed for each group in a data matrix, then drew out the most consistent and persistent themes across both teams and meetings.
This analysis found that many of the factors thought to support the kind of collaboration around data that results in improvement in teaching and learning were present on both teams: teachers on both teams reported high levels of relational trust, believed in the power of data to inform instruction and had a sense of urgency to help their students learn. Neither team embodied the kind of grappling with divergent perspectives thought to promote change. They did, however, differ in three important ways: the extent to which they attended to instruction or curriculum, the extent to which they iterated between data and instructional responses, and the level of expertise the team had within their area of focus.

First, the nature of discourse between the two teams varied depending on whether they focused their attention on curriculum materials or instructional delivery. When the Honeycomb team examined their instructional practice to identify any necessary adjustments or weaknesses, their discussion penetrated the instructional core and focused on interactions between students and teachers around content. Conversely, when the Oreville team focused their attention on curriculum materials, their discussions of instruction attended to issues of pacing, scheduling, logistical tasks of coordinating resources, and task design rather than the interactions between teachers and students that comprise instruction. While not presented in this paper, the third team in the study also focused their attention on examining curriculum and, like the Oreville team, their discussions revolved around issues of pacing. When the Honeycomb team centered their discussion on instruction, their attention was drawn to thinking critically about what they actually do in the classroom and thus they were able to adjust their classroom practice to
meet student needs. On the other hand, by focusing on curriculum the Oreville team avoided any meaningful reflection on their teaching practice and, in the end, they only made superficial changes to instruction.

Second, the Honeycomb team was also careful to iterate between proposed instructional responses and learning gaps they noticed in student data to ensure that their plan addressed the student data, but the same social interaction pattern was not visible in the Oreville team meetings. Indeed, when considering a potential instructional response, Honeycomb teachers were careful to assess the extent to which the response would address the reading gaps noticed in the data and discarded ideas they judged as poor matches to student needs. While teachers made individual instructional decision, they all could articulate how their choices were informed by the data analysis. The Oreville team, on the other hand, lost sight of the writing weaknesses they noticed in data when discussing instructional ideas. While early in the process they did reject some instructional ideas as poor matches for the writing deficits noticed in data, ultimately the instruction they enacted in their classrooms showed little relationship to the specific writing skills they surfaced through data analysis. As a result, their instructional responses, while focused on writing generally, failed to respond to the student data.

Third, teachers’ collective instructional repertoire and knowledge of resources and/or their curriculum materials bounded the landscape of possible solutions the team was able to consider in order to address the student needs noticed in data. Put simply: when discussing what to do about learning gaps noticed in data, teachers drew on
routines that either one team member already knew or were present in their curriculum materials. Instances where teachers successfully looked outside of their shared instructional repertoire in order to collectively learn a new instructional approach were rare and the few attempts observed gained little traction. The Honeycomb team drew on texts from their trainings to surface ‘Clink and Clunk’ and ‘Sketch to Stretch’, but these ideas were soon discarded as they did not address the students’ needs noticed in data. Likewise, the Data Inquiry facilitator introduced ‘Show Call’ to the Oreville team, yet there was little evidence teachers implemented this routine in their classroom. Thus, the data-inquiry process supported teachers’ efforts to match instructional routines within their repertoire and curricular materials to student needs but did not promote the adoption of novel instructional approaches. On the Honeycomb team, teachers possessed instructional knowledge to address the weaknesses in student data and thus were able to meet student needs. On the Oreville team, teachers did not appear to possess the requisite instructional knowledge as the solutions observed failed to address the student writing weaknesses.

Thus, my data suggests the focus of team meetings, iterating continually between student learning problems and teaching practice, and knowledge of teaching practice itself might explain the differences observed in the teams’ use of data to plan and implement instruction. The Honeycomb and Oreville team were similar, however, in that both teams failed to adopt and test novel solutions to their student-learning challenges, and in that most teachers relied upon established instructional practices rather than seeking to uncover more innovative practices. My observation notes that this relates to a
social dynamic present in team meetings, one that resembled a marketplace. In both team meetings, many instructional ideas were ‘for sale’ and individuals, not groups, made choices about what ‘to buy.’ It was unclear how much influence such brainstorming had on teachers’ instructional choices. In the Oreville team, teachers rarely discussed any one instructional idea for more than a few minutes. In both teams, teachers failed to come to a clear consensus on what to do in the classroom. Furthermore, with the exception of a first-year teacher on the Honeycomb team, there were few observable instances when teachers implemented others’ ideas in their classroom. Finally, such discussions of instruction often lacked detail, with teachers naming broad instructional routines, and only occasionally articulating how to enact the instruction in the classroom. In this manner, teachers in all teams preserved a privatized practice.

Summary

Both the Oreville team and the Honeycomb team operated like instructional market places when deciding how to address their learner-centered problems: teachers brainstormed ideas together during inquiry meetings, but individually selected which to transport into their classroom. Yet the two teams also differed in important dimensions. The Honeycomb team focused discussions around instruction, drew on a robust instructional repertoire and maintained a close connection between their instructional responses and the learner-centered problem noted in data. As a result, while they fell short of developing new instructional routines, they were able to effectively target their students’ needs. On the other hand, the Oreville team limited problem solving by focusing conversation around curriculum, lacked robust knowledge on how to teach
writing and failed to keep a connection between their instruction and the students writing weaknesses noticed in data. As a result, their teaching practices were highly individualistic and often failed to address neither the student data nor the writing skills they had discussed during inquiry meetings.

Interesting, both teams considered new instructional routines and yet there was little evidence either group implemented these new strategies in a robust manner. In each team, discussions of the new strategy were brief, taking up no more than a portion of one meeting. Ultimately for both teams, the inherent difficulty of finding a novel instructional routine that also matched the students’ needs noticed in data required more time and effort than was possible given all else teachers were expected to accomplish in the inquiry cycle.

**Discussion**

In this study, one team used data inquiry to share instructional practices with each other and strategically deployed instructional routines within their repertoire to meet the unique needs of their students. Such instructional responses went beyond simply grouping and re-teaching strategies observed in other data inquiry studies (Goertz et al, 2009). However, contrary to the aspiration of the teams and the intention of Data Wise, by and large, data inquiry was not a fertile ground to develop and learn new instruction routines, though it did appear to create social pressure for teachers to deploy the best practices already known to them. Teachers struggled to access instructional routines
outside of their current shared knowledge of teaching or curriculum materials. For the teams with deep knowledge of instruction in their focus area, like the Honeycomb kindergarten team, instructional planning allowed them to select appropriate strategies to target the learning needs identified in data. At the other end of the spectrum, the lack of knowledge about new writing standards and writing instruction more generally resulted in haphazard instructional planning for the Oreville 3rd grade team.

Indeed, a depth and breadth of instructional knowledge related to the focus of inquiry appeared to be a pre-requisite for teachers making effective use of data to improve teaching and learning in their classroom. Such findings are consistent with predictions from cognitive research; teachers prior knowledge and beliefs are a lens through which they interpret new instructional policies (Coburn, 2001; Cohen & Ball, 1990; Putnam & Borko 1997; Spillane & Thompson, 1997; Spillane, 1999; Spillane, Reiser, & Reimer, 2002). And yet, contrary to predictions that such prior knowledge of instruction would undermine teachers attempts to respond to data, it was a boon to one team and a hindrance for another. This suggests that the knowledge teachers bring to data inquiry may largely shape how effectively they are able to use data to inform classroom instruction.

Such knowledge is likely not simply a reflection of what knowledge the teachers themselves may bring to the data inquiry process, but also a reflection of what knowledge is available to them in the larger educational environment. The teachers on the kindergarten team were the beneficiaries of a coherent body of knowledge about how
young children learn how to read and the instructional routines that support such learning. Indeed, early childhood reading is an exceptionally well researched and understood area of education, owing in large part to the work of NICHD and the National Reading Panel in the early 90s. Teachers appeared to have access to that knowledge through their teacher preparation, on-going professional development and an array of assessment tools aligned to this knowledge base. Importantly, teachers brought this knowledge to the data-inquiry process. No such equivalent investment in codifying how students learn to write has transpired and thus the field lacks clear consensus on instructional strategies and educational assessments in writing. The 3rd grade team likely lacked the knowledge of instruction that they needed because they did not have access to the expertise of a local writing specialist, and there was no coherent and robust knowledge base that they could tap into on their own.

Additionally, one pervasive trend across all three teams: teachers struggled in a myriad of ways when discussing instruction. First, one team focused discussions about instruction on curriculum rather than classroom practice—attending to issues of pacing lessons and task design and ultimately making few adjustments. It is unclear if this choice was an attempt to avoid the vulnerability that comes with talking about one’s teaching practice or if teachers had conflated instruction and curriculum. Second, when teachers did reference an instruction routine, they rarely went beyond naming the practice and thus failed to attend to the micro teaching moves that comprise the routine. Though some teachers did talk about instruction in a detailed manner, such descriptions of practice did
not appear to have impact on their colleagues. As a result, teachers missed opportunities to align their instruction or meaningfully share instructional routines with one another.

Indeed, *talking* about teaching with one another only appeared to impact a few teachers’ practice. While novice teachers reported taking away valuable strategies to apply in the classroom, few others reported implementing their colleagues’ ideas. More common, teachers were observed implementing strategies they themselves offered in team meetings. This is not to say teachers did not learn from each other more generally; indeed, all could describe salient instructional techniques they had learned from colleagues over their years teaching. Such learning, however, was often a result of teachers a) seeking explicit support to solve a problem they were experiencing in their classroom and b) observing a colleague in action. Data inquiry, on the other hand, did not appear to provide teachers with the detailed, iterative and reflective conversations about instruction thought to promote instructional change.

**Implications**

The results of this study suggest that data inquiry is best used as an intervention to support teachers strategically deploying instructional routines known among them. For teams in this study, the plans to address gaps in data were only as strong as the resources and ideas available to them—if teachers did not bring instructional knowledge to the data-inquiry process, they were unlikely to adjust their instruction in meaningful ways. Two types of knowledge appeared necessary for this process: knowledge possessed by teachers and knowledge in the educational field more generally.
Consequently, I posit that teachers need to draw upon some intermediary knowledge source outside of the data-inquiry process in order to determine appropriate instructional responses to patterns noticed in data. For example, teachers may need other avenues to learn new instructional techniques – traditional professional development, robust pre-service training and mid-career masters programs. It may be that data inquiry works best in conjunction with other opportunities for teachers to learn new instructional routines, as data inquiry was a fertile ground for teachers in these teams to reinforce and use best practices in their repertoire. It may be that data-inquiry gives teachers the opportunity to make sense of instructional ideas they have encountered elsewhere and deliberately practice such routines in their classrooms. It may also be that the data-inquiry will create social pressure and accountability for teachers deploying best teaching practices in their classrooms.

Furthermore, teachers in this study needed more support to engage in iterative, reflective and detailed conversations around instruction. It may be that teams would benefit from more opportunities to ground conversation about instruction in observation of practice, either by watching video recordings of instruction or more frequent peer classroom observation. Perhaps, additionally, more structured conversational routines and/or facilitators more frequently pressing others to describe instructional practice may help teachers be more explicit about the kinds of teaching moves they make. Finally, this study suggests that a focus on curriculum, while seemingly expeditious, undermines rather than supports conversations about instruction.
Chapter 4: Conclusions

Data-driven inquiry, in one form or another, has become nearly ubiquitous in U.S k-12 schools. Such policies expect that teachers will learn unique and actionable information about their students’ learning needs by collaborative examining data. It is hoped that teachers will be able to then use this information to adjust their instruction to meet these student learning needs. Ultimately, it is argued, student learning will improve as a result. Yet, empirical studies suggest not all teams reap the gains in student learning proponents hope for. The studies in this dissertation aimed to present a detailed account of how teachers engaged in data inquiry in order to understand why some teams are able to improve teaching and learning, whilst others fail to do so.

To do so, each paper examined one component of the theory of action underneath data-driven initiatives. In paper 1, I explored what and how teachers learn from data. I found that ‘data-shapers’ had a precise focus area, methodical plan to collect data and engaged in evidence-bases analysis. In paper 2, I turned my attention to how teachers design and plan instructional responses. I found that collaboration around instructional responses to data operated like a market place: teachers brainstormed ideas together but made individual decisions about what to transport into their classrooms. Furthermore, teachers’ choices were constrained by their shared instructional repertoire. Both papers focused on how teachers’ individual and collective cognitive processes shape the data-driven inquiry process.
What can be learned by looking across the two papers? First, various forms of teachers’ collective knowledge played a large role in both how teachers made sense of data and how they determined an instructional response. In addition to basic assessment literacy skills and access to quality data, teachers needed a depth of knowledge about their focal content domain in order to engage in rich evidence-based discussions that surfaced new knowledge about student learning. Rather than building such knowledge through inquiry, teachers needed to possess the knowledge as a prerequisite to making good use of data. A similar theme was found when teachers were determining an instructional response: they drew upon instructional and curricular knowledge already within their repertoire. Thus, when teachers possessed instructional routines to address learning gaps noted in data, the inquiry process was productive. When they lacked such knowledge, coherent responses to data were few and far between. Thus, at its best, data inquiry practices in this study helped teachers use their knowledge to understand their students’ needs and match their instruction to those needs. In some cases, it may have even created a social pressure by reminding teachers of best practices and encouraging their use or deepened their understanding of particular developmental milestones. It did not prove to be fruitful playground for learning new instructional routines nor developing knowledge about the student skills embedded in a particular content area where only fragmented understanding was present.

A second important take-away from looking across the two papers: there was greater variation in how teachers engaged in data analysis than in how they planned
instruction. One team modeled the kind of strategic data use proponents of data-driven inquiry hope for. They collected multiple, high quality assessments. They organized the data to facilitate pattern finding. They grounded observations in evidence, while other teams either didn’t have access to data or were more driven by their impressions of student learning based on their experience in the classroom. On the other hand, while some differences existed, all teams struggled in similar ways when determining instructional responses. Discussions of instruction lacked detail. Teachers made individual decisions about what to implement in their classrooms. Many reported appreciations for analyzing useful data but expressed reservations about how much they learned about instruction.

So, what are the most important take-aways for school leaders and policy makers? First, when a robust knowledge base exists and teachers have access to it and to high quality data, they can use data to strategically deploy their skills in their classroom. Second, teachers need avenues outside of data inquiry to learn new instructional methods and unpack and make sense of standards. Inquiry was a venue where teachers made good use of such knowledge, but it was not where such knowledge was developed. And finally, teachers need routines to deepen conversations about instruction and more frequent opportunities to observe each other teach. Data-inquiry, while imperfect for these three teams, still held promise to improving teaching and learning.
## Appendices

**Appendix A: Interview Protocols**

<table>
<thead>
<tr>
<th>Interview</th>
<th>Topics/construct</th>
<th>Questions</th>
<th>What these questions will capture</th>
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</thead>
<tbody>
<tr>
<td><strong>Start of year</strong></td>
<td>Background</td>
<td>Tell me how you became a teacher? How long have you been teaching? How would you describe the job of teaching to someone who has never taught?</td>
<td>General background Beliefs about their role as a teacher Disposition to reflecting on teaching</td>
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<tr>
<td></td>
<td>Beliefs about Data Use</td>
<td>Talk to me about data use and teaching – in the ideal world, how should teachers use data? How did your team come to choose to become a Data Wise team? Describe the Data Wise Process to me.</td>
<td>Beliefs about using data Understanding of data use policy</td>
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<td></td>
<td>Experience collaborating with their colleagues</td>
<td>Talk to me a little about your teaching team. What is it like working together? Describe a typical team meeting. Talk to me about how, if at all, your team shares ideas about teaching. Tell me about a time you learned something from a colleague. Who do you tend to seek advice from on the team? Why? Is it okay on this team to talk about challenges you are having in the classroom? Do teachers respect each other on the team?</td>
<td>Relational trust that supports risk taking Taking up or dismissing others’ ideas about data or instruction How, if at all, teachers learn from each other Heterogeneity of group Value of autonomy v. shared sense-making</td>
</tr>
<tr>
<td></td>
<td>Experience using data with team</td>
<td>Talk to me about how the team uses student data. What kinds of data does the team look at?</td>
<td>The extent to which the team: Draws on multiple pieces of data</td>
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</table>
### Data Scenario

**Ask teacher to bring a recent data report for one or more classes of students (i.e. interim assessment, state assessment or other school generated data report).**

Think aloud as you look at the data report. What patterns do you notice about student learning? What do students appear to be struggling with? What, if anything, do you think needs to happen instructionally in response to the data report?

What do you think your colleagues on your team might notice? How might they respond instructionally?

- **Entertains multiple interpretations of data and instructional responses**
- **Iterates between data and teaching**
- **Taking up or dismissing others’ ideas about data or instruction**
- **How, if at all, teachers learn from each other**
- **Heterogeneity of group**
- **Value of autonomy v. shared sense-making**

### Post-classroom observation

**Tell me about today’s lesson. I heard you say today’s goal was __________? How did you decide to focus there? How did you decide what activities to plan to meet that goal? Did you consider any other activities than the ones you used? How, if at all, was the lesson informed by your analysis of student data? How, if at all, was the lesson informed by your collaboration with colleagues?**

Review specific portions of video (or describe low inference observations) in order to further probe teacher’s pedagogical decisions. Try to highlight portions of lessons that either a) address concerns raised in student data analysis; b) exemplify instructional approach discussed in team meeting; c) depart from instructional approach discussed in team meeting.

- **Use of instructional response already in teachers repertoire**
- **Use data to validate existing beliefs**
- **Consider multiple instructional responses**
- **Prior knowledge about students and content**
- **Disposition to reflecting on teaching**
- **Take up or dismissing others’ ideas about data or instruction**
- **Learn by following another colleague’s example or by grappling with colleagues’ divergent viewpoints**
- **Consider multiple instructional responses to data**
- **Iterate between data and teaching to draw clear connections between how the instruction does or does not attend to the student-learning process**
Let’s look at a specific portion of today’s lesson together to talk about further. Can you describe in your words what was happening during this segment? I saw you doing X in this segment, and wondered how you decided to plan that into the lesson?“ Or “I noticed you asked Student Y to produce A; what were you thinking when you made that request? How was that decision related to the data analysis? Did you think about any other possible instructional responses? Besides the data analysis, what else informed your decision to do X?

Let’s talk about the data-inquiry cycle. Tell me how today’s lesson relates to what you have been discussing at your team meetings, if at all? What, if anything, from today’s class will you share with your colleagues next team meeting? Why?

<table>
<thead>
<tr>
<th><strong>End of year</strong></th>
<th><strong>How teacher feel their teaching has changed as a result of collaborating with colleagues.</strong></th>
<th><strong>Beliefs about data use and collaboration</strong></th>
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<td></td>
<td>If you were to describe the data-inquiry process to a teacher not at your school, what would you say? What advice would you give to teachers at a school considering adopting this data-inquiry process? Describe a typical data-inquiry cycle that your team undertook this year. How did you examine data? Please give examples. What was the process of examining data like for you? What kind learning challenges did the team identify? Please give examples. What kinds of instructional responses did the team generate? Please give examples. What was the process of determining instructional responses like for you? How has participating on the team and engaging the data-inquiry cycle effected your teaching, if at all?</td>
<td>Beliefs about data use and collaboration Use of instructional response already in teachers repertoire Use data to validate existing beliefs Consider multiple instructional responses Disposition to reflecting on teaching Taking up or dismissing others’ ideas about data or instruction Learn by following another colleagues’ example or by grappling with colleagues’ divergent viewpoints Consider multiple instructional responses to data Iterate between data and teaching to draw clear connections between how the instruction does or does not attend to the student-learning problem in order to refine their instructional response. Value individual autonomy over shared sense-making</td>
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115


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