

THE FLOOD AT THE FOOT OF THE CLASSROOM DOOR:
SECONDARY MATHEMATICS AND ENGLISH TEACHERS
DESCRIBE DATA-DRIVEN DECISION MAKING

by
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ABSTRACT

The Flood at the Foot of the Classroom Door:
Secondary Mathematics and English Teachers Describe Data-driven Decision Making

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PROBLEM: Data-driven decision making has been a focus of school reform efforts for decades. As new testing and teacher evaluation regimes take hold, the focus on data analysis in schools only sharpens. Policy makers assume that teachers and school leaders have capacity for and common conceptions of that work, but the profession still wrestles over basic definitions. Researchers have connected outcomes to specific data analysis projects, described effective data analysis tools and structures, and uncovered normative cases, but have not yet described teacher practice with data (Coburn & Turner, 2012). Teachers are frontline implementers of policy, so their conceptions and practice are of utmost importance. Guided by the following research questions, this study explores how teachers engage with data.

- How do high school math and English teachers describe their use of data to inform instructional decision making?
- What obstacles influence their decision making as they plan for and engage in data analysis?

METHOD: This comparative case study collected data from 18 teachers and 4 administrators working in 3 New Jersey high schools that vary in size and socioeconomics. Interviews provided the basis for data collection, followed up by reviews of professional literature from publishers that participants discussed. Transcribed interviews were coded and analyzed according to a conceptual framework and questions that guided the inquiry.

FINDINGS: Teachers describe practices along a continuum of formality—the degree of codification and standardization of data. As formality increases, teacher control over data and teacher perceptions of usefulness of data decrease. Teachers value informal data the most, and rely on their experience and status as trained specialists to lend validity and reliability to those data, even if they believe that administrators and policy makers may believe the data to be invalid and/or unreliable. Teachers describe time and tools as structural obstacles to data analysis, and appreciate the efforts of administrators who try to mitigate those barriers. Teachers also describe students as obstacles; student motivation and other qualities affect the validity and reliability of data. Professional literature offers some suggestions on how to overcome many obstacles, but does not often address the notion of students as obstacles. Where the professional literature does, it describes teacher bias as the most likely cause.

SIGNIFICANCE: Though policy mandates data-driven decision making in schools, there is little understanding of teacher practice and conceptions. This study answers research agendas calling for more inquiry in this direction, but recognizes that basic definitions are not yet resolved. The findings have informed the development of a typology of data in schools, which future researchers may use to further explore teacher practice and conceptions.

I dedicate this work to Meghan, Ian, Madeline, and Alexandra, with
gratitude for patience and confidence that carried me through.

ACKNOWLEDGEMENTS

A colleague once told me “the only good dissertation is a finished dissertation.” He was saying that the paper itself is just the last and largest hassle that a doctoral student encounters. I do not see this dissertation as a discrete project. In some ways, it is the end of a journey that began decades ago, in a very small chair in a kindergarten classroom. I have spent my life in schools—as a student, a teacher, and an administrator. It is odd and somewhat jarring to think that my formal education in schools may be over. It is gratifying to finish this project, but also a little bewildering.

I therefore have to extend thanks to all of my teachers, past and present. Most recently, Dr. William Firestone exercised incredible patience and provided invaluable guidance. He does that for all of his students, and I am lucky to be among them. Dr. Roberta Schorr walked me through turning points in this project that proved to be breakthroughs. Dr. Tanja Sargent reminded me that the best qualitative research tells a story. Dr. Alisa Belzer guided my pilot study, demystifying the dissertation altogether. Also, all of the teachers who participated in this—you deserve thanks, much more than you deserve to wrestle with the confusion that this dissertation describes.

Family and friends deserve more than thanks for simply putting up with this. Most importantly, my wife Meghan has as much claim to the accomplishment as I do. I would not have started if she had not pushed me, and would never have finished without her support. My children Ian, Madeline, and Alexandra sustained me through this. My parents and siblings not only supported me, they set me on the path that started in that small chair, in that kindergarten classroom.

TABLE OF CONTENTS

ABSTRACT.....	iii
DEDICATION	v
ACKNOWLEDGEMENTS	vi
TABLE OF CONTENTS.....	vii
LIST OF TABLES	ix
LIST OF FIGURES	x
CHAPTER I: Introduction	1
CHAPTER II: Review of Literature	6
Defining "Data"	7
Factors Influencing Teacher Data Use.....	12
Summary	19
CHAPTER III: Methodology.....	22
Overall Design	22
Settings.....	23
Research Sample	28
Data Collection	31
Data Analysis	35
Role of the Researcher	36
Issues of Validity and Reliability.....	37
Limitations of Methodology	39

CHAPTER IV: Findings	42
Formality	42
Obstacles	66
Professional Literature	70
Summary	75
CHAPTER V: Discussion	76
Defining “Data”	76
Obstacles to Data Use	87
Implications for Practice	93
Study Limitations	96
Recommendations for Further Research	98
Summary	100
REFERENCES	101
APPENDICES	112

LIST OF TABLES

Table 1 Participant Information	30
Table 2 Professional Literature	34
Table 3 Formality: Frequencies of Codes and Numbers of Teachers	45
Table 4 Practices with Classroom Data: Frequencies of Codes and Number of Teachers	46
Table 5 Practices with Collaborative Data: Frequencies of Codes and Number of Teachers	53
Table 6 Practices with Outside Data: Frequencies of Codes and Number of Teachers	58
Table 7 Obstacles: Frequencies of Codes and Numbers of Teachers	66
Table 8 Professional Literature Reviewed	71
Table 9 A Typology of Data in Schools	78

LIST OF FIGURES

Figure 1 Factors thought to influence data-driven decision making in schools.	7
Figure 2 Data and data analysis formality mapped against teacher control.	43

CHAPTER I:

Introduction

On January 8, 2002, President George W. Bush stood before a crowd of students in the battleground state of Ohio to announce the beginning of a new era in American education (“President signs landmark No Child Left Behind education bill,” 2002). After chants of “U.S.A!” subsided, he declared: “No longer is it acceptable to hide poor performance. ... to keep results away from parents” (“President signs landmark No Child Left Behind education bill,” 2002). Schools receiving federal funding increasingly found themselves under the watch of state and federal agencies. A call for “data-driven decision making” and “evidence-based practice,” with student achievement on summative standardized tests the most important and most publically-scrutinized measurement, echoed from the highest levels of the national government, through state departments of education, and down into the very classroom itself.

The era of No Child Left Behind has closed, short of its 2014 milestone for 100% student achievement. President Barack Obama nonetheless carries the banner for data-driven decision making. Race to the Top, President Obama’s education initiative, emphasizes state- and school-level data systems that not only track student achievement, but also facilitate the information-rich evaluation of teachers (US Department of Education, 2009). Those evaluations should consider many facets of teacher work, not just student achievement (US Department of Education, 2012). Data-driven decision making, then, moves from something that teachers must do to something

that is also done to them across aspects of the profession that are not easily quantified, and for which there are no standard rubrics for evaluation.

Despite nearly two decades of inquiry, researchers have not yet drawn a complete picture of teacher conceptions of and practice with data. Cynthia Coburn and Erica Turner (2012) observe that the literature on data analysis flows in three streams: connecting outcomes to efforts within specific data-driven decision making projects, discussing qualities of effective data systems and other structures, and establishing normative cases. The details of teachers practice—the what's and how's of teacher belief and action—remain a mystery. In 2012, the *American Journal of Education* gathered Coburn and other pre-eminent scholars working to understand teacher collaboration and data use. The resulting collection of articles advances a long overdue research agenda to understand teacher work with data once and for all.

We are not completely blind as we explore questions about teacher data use. Researchers, particularly in the first of the streams identified by Coburn and Turner (2012), can show that data use has impacts. Careful school and teacher data use accompanies increases in student achievement (Feldman & Tung, 2001; Wayman, 2005). When schools maintain focus on data, they can foster student metacognition (Payne, 2003), respond to public concerns (Larocque, 2007), and pinpoint student weaknesses (Ysseldyke & Bolt, 2007; Ysseldyke, et al., 2003). Through data use, school leaders can foster continuous improvement by aligning internal and external accountabilities (Thornton, et al., 2007).

Schools have nonetheless struggled with data-driven decision making. Teachers lack time (Ingram, et al., 2004; Breiter & Light, 2006; Kerr, et al., 2006). They also lack sufficient knowledge to use data and data analysis tools, even after extensive training (Brunner, et al., 2005; Kerr, et al., 2006; Supovitz & Klein, 2003). Often, the data that teachers need are

unavailable or hard to access (Luo, 2008; Mandinach, et al., 2006). Sometimes, teachers ask for data that are impossible to collect (Breiter & Light, 2006).

The architects of accountability policy mistakenly assume that teachers and educational leaders have both the capacity and a common vision for approaching data (Wayman, 2005). In mandating that school reforms be aligned to scientific research (NCLB, 2001), policy makers also assumed that there is a large body of research that advances commonly accepted best practices for the use of data in schools. This is far from the case. The research literature does not even agree on definitions of “data” or “data-driven decision making,” meaning that the three streams of inquiry that Coburn and Turner (2012) identify do not, in the end, feed a well-formed body of literature.

Research, then, needs to explore other traditions to find a basis for examining teacher use of data. In this study, I look toward sociology and organizational theory to understand how teachers work together with data in a profession that is shifting in the face of calls for evidence-based practice. Teachers are front-line implementers of policy, and therefore sensemakers (Spillane, Reiser, & Reimer, 2002). Traditional views of the teaching profession, however, describe work that is isolated and self-directed rather than collaborative and data-informed (Lortie, 1975; Goldstein, 2003). School and district leadership traditionally worked to buffer teacher practice from external expectations rather than facilitate alignment to them through data analysis (Elmore, 2000). New accountability policy may be forcing a shift, with data-driven decision making spinning at the pivot point.

New Jersey presents an interesting setting for investigating this shift. At this writing, it joins other states in implementing national standards, new standardized testing, and comprehensive reforms in the evaluation of teachers. I have chosen three high schools of varying

size and demographic qualities for an exploration of teacher perceptions and descriptions of data use in New Jersey. Each high school has professed a commitment to evidence-based practice. Raven High School is the smallest of the three. It serves an affluent community in northern New Jersey, within commuting distance of New York City. Eagle High School in central New Jersey is much larger, though serves a similarly well-off community. Hawk High School stands in rural southern New Jersey, where it struggles with far more socioeconomic challenges than either Eagle or Raven. Hawk and Raven operate within K12 districts. Eagle High School operates within a regional high school district; students attend Eagle from multiple and independent K8 districts.

This comparative case study views data-driven decision making through a constructivist lens; participant perceptions are crucial to understanding how the phenomenon evolves in their workplace (Creswell, 2007). The purpose of this study is build theory around how teachers perceive and approach data-driven decision making. The following questions guide my review of the literature, the development of my methodology, and the analysis and discussion of my findings:

- How do high school math and English teachers describe their use of data to inform instructional decision making?
- What obstacles influence their decision making as they plan for and engage in data analysis?

Researchers call for more exploration of teacher practice with data, but we lack an understanding of how teachers approach and even understand the key concepts. We do not know how the profession defines “data” and “data-driven decision making” in the face of rapidly advancing mandates. We do not have an understanding of how different pressures may interact

with different types of data analysis projects, and different types of data. We know something about obstacles and impacts, but lack a true foundation for understanding how data analysis actually happens in schools. This study hopes to build some of that foundation.

CHAPTER II:

Review of Literature

Research literature on data-driven decision making in schools has concentrated on tying outcomes to specific data analysis projects, describing systems and structures, and attempting to provide normative cases (Coburn & Turner, 2012). Researchers have not reached consensus on how to measure teacher perceptions of data, or drawn a complete picture of teacher practice with data. There are few descriptions of the contexts, attitudes, and structures that best support data-driven decision making across different content areas. In fact, there is not even a universally accepted definition of “data.”

A conceptual framework for approaching my research questions therefore must weave multiple bodies of literature together to inform the development of an appropriate methodology. Sociology and organizational theory identify several factors that may influence teacher perceptions of and practice with data. Existing literature on data provides additional information about capacity and obstacles that teachers are likely to describe. The resulting framework, Figure 1, identifies factors influencing teacher data use.

The framework describes a loop in which sensemaking serves as an anchoring point. Sensemaking influences conceptions of data-driven decision making that either promote or interfere with implementation. Sensemaking also influences organization and politics, and capacity and structures. With regard to organization and politics, organizational theory describes changes in American public schooling that have had impacts upon how schools work with data,

particularly data from external sources of accountability. Organizational theory also provides insight into the political pressures that schools react to and attempt to exert in order to maintain control over data. In addition, schools require capacity and structures in order to make the best use of data. Knowledge, tools, and time represent some of the most discouraging obstacles to the effective implementation of data-driven decision making. Impacts of data-driven decision making create conditions that influence sensemaking, thus closing the loop.

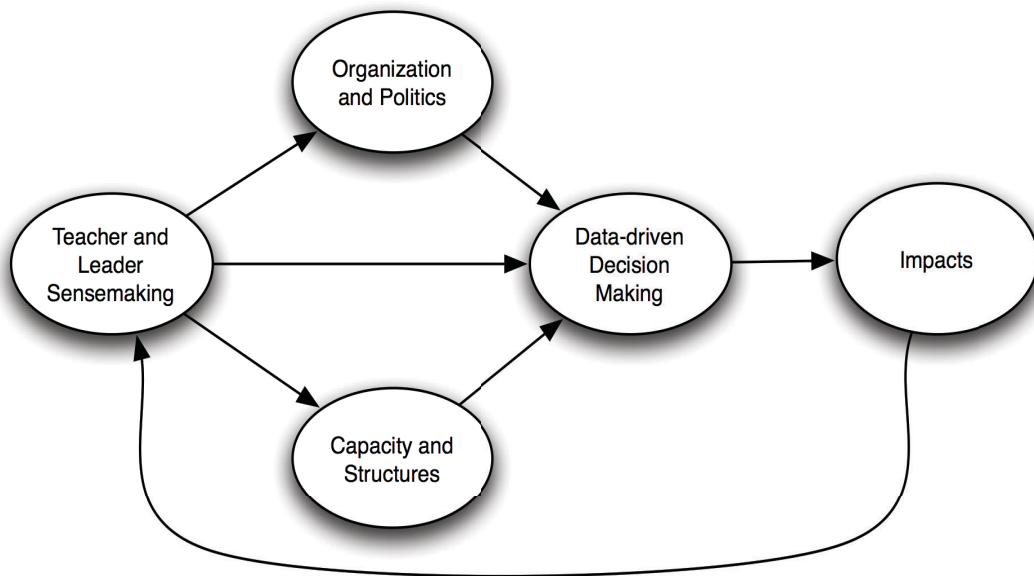


Figure 1. Factors thought to influence data-driven decision making in schools.

Defining "Data"

There is a lot of confusion about what “data” actually are. Reviews of literature find that there is little discussion on what data teachers use, and how they use it (Young & Kim, 2010; Little, 2012). Yet, there are several different definitions of the term. Research literature up through the early 1990’s is likely to define data as *evidence* of student achievement (e.g., Black & Wiliam, 1998). During the early 1990’s, educational theorists argued about the impacts of W.

Edwards Demings' continuous improvement philosophy (*cf.*, Holt, 1993 and Kohn, 1993). As Demings' ideas spread through education, research literature might define data more broadly, as *feedback* within any process of organizational learning or continuous improvement (e.g., Crawford, et al., 2007 and Ingram, et al., 2004). Those two conceptions—data as evidence of student learning or as feedback within a larger systems context—persist in research and professional literature today.

The difference between the two is not so clear as to be captured by “tests” and “more than tests.” Evidence of student achievement is not confined to test scores in either camp. Student achievement data come from multiple sources, and may be both quantitative and qualitative. State and district summative assessments yield data that answer to external sources of accountability (Halverson, et al., 2007; Supovitz & Klein, 2003). Schools and teachers also engage in formative assessment to inform planning and to build structures of internal accountability. Teachers use many different tools to collect these data: portfolios, peer observations, authentic assessments, unit/chapter assessments, conference logs, rubrics, and others (Knapp, et al., 2006; Supovitz & Klein, 2003). A classic review by Black and Wiliam (1998) describes “tasks” covering a wide range of measures that teachers deploy to gauge understanding and promote reflection among students. A teacher engaged in the differentiation of instruction, for example, may examine data on student utilization of certain resources (e.g., access logs from an online learning system), results from formative assessment activities, student attendance rates, student articulation of strengths and weaknesses, and perhaps even student schedules to determine individualized learning plans. Test scores, while an element of that practice, are not the only element of data.

Today, teachers are required to engage with data from various sources and arising from many phenomena. Though many states still focus upon evidence of student achievement on standardized tests to describe the success of schools, teacher evaluation requirements are more nuanced. The United States Department of Education, in a document outlining its vision of teaching in the 21st century, describes teacher evaluation across many facets of organizational and individual performance:

The evaluation systems we envision would include a range of summative and formative components, such as an analysis of teacher responsibilities and accomplishments, measurements of student growth data, results from formal observations, self-evaluations, and feedback from students and peers. These evaluations would be more meaningful and useful, informing decisions related to all aspects of advancement, including compensation, tenure and dismissal. (US Department of Education, 2012)

Toward this end, a majority of New Jersey school districts have chosen to implement Charlotte Danielson's "Framework for Teaching" evaluation model (Mooney, 2013). This model focuses on teacher activities rather than student achievement, and considers activities occurring both inside of the classroom (e.g., "Managing classroom procedures") and outside of the classroom (e.g., "Participating in a professional community") through domains of professional behavior (Danielson Group). The New Jersey Department of Education weighs "practice scores" arising from models like the Danielson Framework for Teaching at either 55% or 85% of a teacher's total evaluation score, with student achievement toward teacher-developed growth objectives and/or student achievement on standardized tests filling in the rest of the score (New Jersey Department of Education, 2013).

This study takes a broader systems view of data. The current accountability climate, in which data on a variety of activities and outcomes influence teacher evaluation, is one factor in that decision. A broader definition affords my study some relevance in that climate. From a

methodological standpoint, however, a broader definition allows me wider latitude to consider “data” as teachers conceptualize the term, rather than as a strictly-defined phenomenon that disqualifies relevant practices that teachers may describe.

Positive impacts of data use. Despite differences on definitions, research literature seems unified on the idea that data-driven decision making can have positive results. Researchers working as early as 1971 assert that careful teacher use of data correlates to increased student achievement, and that such use of data contributes to the unusually high performance of outlier schools in some samples (Wayman, 2005). Research also suggests that careful and proper data use can facilitate student self-awareness and metacognition (Payne, 2003). Case studies designed to explore best practices have described schools in which student achievement improved after the careful use of data (Feldman & Tung, 2001). A school in Florida, for example, met with success when it responded to the publication of standardized testing scores by developing strategies for analyzing those scores, along with data on attendance and other phenomena (Larocque, 2007).

Such qualifications as “careful” and “proper” are common in the literature. They sometimes signal data use within a context of formative assessment. Researchers note positive changes in mathematics achievement after the introduction of a computer-based monitoring and assessment tool that allowed teachers to track and react to data on student progress (Ysseldyke & Bolt, 2007; Ysseldyke, et al., 2003). Students did not improve, however, when teachers did not use the computer-based system as instructed—as a formative assessment tool that would allow them to adjust and differentiate instruction (Ysseldyke & Bolt, 2007).

“Careful” and “proper” can also refer to focus. Teachers must focus on data rather than wander in their analyses to more general factors not necessarily evident in or supported explicitly by the data: instructional practice, parent satisfaction, and other factors (Little, et al., 2003). In a

study of conversations about data in schools, Earl (2008) describes a principal who continually refocused teacher attention on data representations that she had prepared. Her conversation was strategic and thoughtful, designed to bring teachers to more specific findings that were grounded in data. One might also characterize her questions as leading, for the teachers did not quickly find their way to conclusions that seemed evident to her. Timperley (2008) likewise found differences in focus among seven New Zealand schools leveraging data-informed professional learning communities to raise student achievement. Schools with higher increases, he argues, exhibited a more sustained focus on evidence and information about students. Little and Curry (2008) point out that protocol-based schemes such as professional learning communities are not always the remedy for a lack of focus. Teachers may actually focus on the protocol—the script of their data analysis activity—rather than the data themselves, in much the same way that they focus on sharing and discussing classroom practices rather than conclusions from the data. Little (2012) calls it the “activity trap.”

Teacher practice with data. Coburn and Turner (2012), introducing a special issue of the *American Journal of Education*, note that our understanding of actual data use in schools comes primarily from three streams of literature. Research has sought to connect specific data analysis projects to outcomes, describe structures and systems that schools use, and advance normative descriptions of data use (Coburn & Turner, 2012). These streams have not led to greater understanding of the factors that influence teacher work with and understandings of data (Coburn & Turner, 2012). Focusing on practitioners’ activities and decision-making, they argue, may reveal much about teacher actions in context, thus revealing why they do what they do (Coburn & Turner, 2012).

Black and Wiliam (1998), by focusing on “tasks,” may mark the starting point for describing actual teacher practice. I therefore approach my research questions by first asking teachers about specific practices. A broad definition of data, with a focus on teacher descriptions of practice, allows me to view data use in schools through a constructivist lens. In a constructivist approach, participant perceptions are crucial to understanding how the phenomenon evolves in their workplace (Creswell, 2007). To further inform my framework and my methodology, I turn next toward literature describing factors that are likely to influence teacher data use.

Factors Influencing Teacher Data Use

Given the fact that there is not yet a cohesive body of literature to inform research questions about teacher practices and perceptions of data use, I have had to reach in several directions to build my framework. Sociologists describe teaching as a profession that predisposes its practitioners to isolated rather than collaborative work. Organizational theorists describe political and other forces that have pushed to schools to resist (or, at best, have contributed to a lack of capacity for) data use. Literature in these areas leads me to consider teacher sensemaking, organization and politics, and capacity and structures in my framework.

Sensemaking. As teachers work with data, they find themselves in the role of frontline implementers, and therefore sensemakers, of data-driven decision making policy (Spillane, Reiser, & Reimer, 2002). People make sense of policy, and everything else, from an understanding of self that they forge through interaction with others, through a process of reaction and observation (Weick, 1995). Normative cases of data use in research literature tend to involve interaction and collaboration (Coburn & Turner, 2012). Teachers engaging in collaborative data-driven decision making must not only be able to reflect upon their practice,

they must also have the capacity and willingness to unlearn current practice and learn new practice (Spillane, 1999).

True collaboration may be a tall order. The traditional understanding of teachers' work is that it resists collaborative input and is highly self-directed (Lortie, 1975). Even when teachers do work together, they may choose to interact in ways that still preserve their independence. Little (1990) proposes a continuum running between independence and interdependence. In that continuum, such common collaborative activities as storytelling, sharing, and assistance do not reach as far toward interdependence as truly joint work, in which teachers share accountability and work in structures toward the achievement of organizational goals. Professional literature has attempted to address barriers to truly collaborative work—and collaborative work with data—by introducing protocols and structures for joint work (*cf.* DuFour & Eaker, 1998).

Teacher content area may also influence sensemaking of data-driven decision making. Though some researchers consider content knowledge to be a facet of experience (e.g., Little, 2012 and Goren, 2012), others describe content area as a potentially separate influence. Research literature on the supervision of instruction, for example, cautions that data may take different forms in different content areas (Nelson & Sassi, 2000). Educational psychology describes expertise as requiring domain-specific content and procedural knowledge (Collins, et al., 1989; Slotta, et al., 1995), which would affect the shape of assessment and therefore data collection in different content areas. In a three year longitudinal case study, Coburn and colleagues (2009) argue that content areas influence many facets of evidence-based decision making: ideas about how students learn, conceptions of best practices, and more.

Different pedagogical paradigms (behaviorist and constructivist) may also influence sensemaking. Researchers have not dealt with this question explicitly, but have confirmed that

teachers from different paradigms create different opportunities for learning within the same content area. Even and Kvatinsky (2010) go as far as to describe “different mathematics” that teachers working from different paradigms offer to their students, even when they are using the same textbooks. We can imagine very different assessments of learning in the different classrooms, and therefore very different kinds of data and data analysis. We then recognize variations within paradigms, and see that two constructivist classrooms may possibly yield very different data.

Together, this literature draws a picture in which sensemaking may predispose teachers to value data that they generate themselves, within their own classrooms. Collaborative arrangements may begin to trip circuits of teacher control and privacy. Protocols and other detailed structures have arisen to help teachers navigate through these arrangements, from basic collegial to truly collaborative work. The variety of shapes of data in different content areas and pedagogical paradigms, however, may be an obstacle.

Organization, politics, and data. Organizational theory describes the landscape through which teachers move as they make sense of data. Some researchers and theorists suggest that recent accountability policy has changed this landscape, creating new political realities and organizational structures. Government agencies now tend to control both the timing and message of announcements about student achievement on high-stakes standardized tests (Earl & Fullan, 2003; Mountford, 2004). External accountability’s use of data therefore represents a rubber mallet upon the kneecap of a school’s political reflexes.

In his classic study of teachers and their workplaces, Dan Lortie (1975) describes a “monolithic” system of public education in which a school board composed of non-educators from the community set the course for and evaluated the success of schools. Throughout the 19th

and 20th centuries, central offices developed as a level of bureaucracy between teachers and the laypeople they served (Lortie, 1975). Superintendents could draw a scrim to soften the harsh light of external accountability before it fell into the classroom; the truth of classroom practice, likewise, passed through this transforming screen before it reached the community (Goldstein, 2003; Lortie, 1975).

Elmore (2000) notes that district administrators working in this context do not manage instruction, but rather manage “the structures and processes around instruction” (p. 6) to buffer the classroom. In Elmore’s view, this loose coupling between teachers’ work and the evaluation of that work is the mortar in the foundation of American public education. District administration, the argument goes, protects expert educators from meddlesome intrusion by non-experts in the community. The data that external accountability bring to the discussion is therefore fated to be irrelevant to the classroom teacher. In this kind of organization, accountability policy creates work at the district office, but most likely fails to create an imperative for teachers to change their practice (Kerr, et al., 2006).

As accountability now shifts to the school and its teachers, however, the roles of various actors (including central office administrators) become more important as teachers work with data. Honig and Venkateswaran (2012) argue that data use is not just a school-level challenge in current accountability contexts, but a systems challenge affecting all levels of the organization. Policy-makers now demand data-driven decision making in schools and central offices. Warehousing systems on both state and federal levels collect and report on those data. Central office data use now influences school data use, and vice versa (Honig & Venkateswaran, 2012).

Instead of buffering teachers from accountability, school and district leaders must now connect teachers directly to accountability. Researchers have discussed the extent to which

school and district leaders can influence teacher practice in general. Teachers, for example, generally echo the conceptions of professional development held and communicated by a “dominant coalition” of district leaders (Firestone, et al., 2005). School and district leaders can influence whether a school’s culture leans toward reflective and improvement-oriented “organizational learning” or traditional “accountability” responses to mandates (Firestone & González, 2007). Artifacts and tools provided by the district can also affect a teacher’s ability to contribute to a successful implementation of reform (McLaughlin, 1992; Spillane, Halvorson, & Diamond, 2001). The district office can even influence teachers’ pride in and conception of their work as teachers (McLaughlin, 1992). It seems possible, then, that districts and schools can use mandates for data-driven decision making from external sources of accountability as opportunities to improve (Thornton, et al., 2007). Though district offices may be in a state of transition, research literature suggests that they can create supportive contexts for teachers’ data-driven decision making.

District leaders must tread lightly. Teachers have their own opinions about the amount of control that the central office should exercise over the classroom (McLaughlin, 1992). Top-down mandates may lead teachers to view the district office as a meddlesome external force rather than as a partner in continuous improvement (Herman & Gribbons, 2001). Coburn (2005) has shown that teachers may actually be more likely to change their practice when non-system actors (such as independent professional development providers) bring the messages of policy, rather than system actors (such as district leaders).

Changes in American public schooling have therefore created new accountability contexts demanding new reactions from schools and teachers. While schools had been organized to shelter teachers from external accountability, they must now facilitate direct connections

between teachers and external accountability. Policy makers and researchers alike envision data-driven decision making as a tool for forging those connections.

Capacity and structures. District and school leaders may be limited in overcoming organizational and political obstacles to data-driven decision making. Leaders can, however, work with teachers to create more capacity for the careful and proper use of data (Firestone, et al., 2005; Firestone & González, 2007; McLaughlin, 1992; Spillane, Halvorson, & Diamond, 2001). The research literature shows this to be necessary in order to realize positive impacts of data-driven decision making, but has not yet considered teachers' opinions and conceptions of their own capacity. There may be a gap between the tools and strategies that researchers recommend, and those that teachers feel they need or can use.

Many researchers cite insufficient teacher capacity to draw conclusions from data (Brunner, et al., 2005; Kerr, et al., 2006; Supovitz & Klein, 2003). Indeed, one study of data use in 24 elementary and middle schools in Iowa shows that teacher leaders tasked with "turn-keying" best practices of data use to their colleagues failed to engage in correlational and other basic analyses, even when the data and tools to support such studies were readily available (Henning, 2006). Even after a year of training, teachers in a study of formative assessment in Milwaukee schools felt that they did not possess enough knowledge to effectively use data to guide their practice (Mason, 2003).

When unprepared teachers engage in data-driven decision making, the results can be harmful. Researchers found that New Jersey teachers added decontextualized test preparation activities alongside activities aligned to curriculum (Monfils, et al., 2004). This "teaching to the test" may happen more in disadvantaged than in wealthy school districts, due to different accountability requirements, thus contributing to inequity of student access to a meaningful

curriculum (Monfils, et al., 2004). Teachers lacked the capacity to conduct analysis that would lead to other decisions. They were, for example, responding to averages and other “big picture” data, rather than delving into cluster scores or other important evidence (Monfils, et al., 2004).

Availability and quality of data complicate this lack of capacity (Luo, 2008; Mandinach, et al., 2006). Often, teachers do not understand or cannot articulate the types of data that they need in order to make certain decisions (Breiter & Light, 2006). Mike Schmoker (2003), writing in the professional literature, describes such a teacher as “a mechanic who does not know which part of the car to repair” (p. 23). Or, teacher understanding of data-driven decision making leads them to seek measurements that do not or even cannot exist (Ingram, et al., 2004). Teachers may request indicators of student achievement—success in adult life, for example—that the school has no ability to collect within a timeframe that is useful to teachers.

In addition to training, teachers require time and tools to analyze data (Ingram, et al., 2004; Breiter & Light, 2006; Kerr, et al., 2006). Teachers cannot, after all, leave their posts to access useful data that do not exist within the classroom (Breiter & Light, 2006). The lack of user-friendly and accessible technology to assist in the aggregation and analysis of data exacerbates the obstacle of time (Breiter & Light, 2006). Researchers have given examples of districts that provide resources and time in support of the type of job-embedded professional development that relies so heavily upon teacher practice of data-driven decision making. Elmore and Burney (1999), for example, describe New York City’s District 2 under Superintendent Anthony Alverado. District 2 realized that it had to take a long view on a strategic plan unfolding over several years to develop teachers and leaders to identify needs, make change, and measure results (Elmore & Burney, 1999). Too often, teachers and principals lack such a comprehensive structure to adjust practice. Researchers in New Jersey, for example,

found that principals generally make marginal rather than comprehensive changes to enable teachers to respond to data from high-stakes testing (Firestone, et al., 2004).

Even though technology and time are not yet available to all teachers, researchers still advocate the collection of mind-boggling amounts of new data. Dembosky and colleagues (2005), for example, ended a study of data use in southwestern Pennsylvania schools by calling for statewide warehouses of longitudinal student data. A glut of data flooding a system lacking appropriate tools and sufficient capacity may promote over-analysis and massive, time-consuming planning that ultimately leaves teachers data rich but information poor (Wayman & Stringfield, 2006).

Schools may lack the capacity to use data in meaningful ways. Indeed, they may not even have a complete understanding of how to build capacity. In the research literature, individual capacity (proficiency) combines with organizational capacity (time, tools, and leadership) to pinpoint many obstacles. However, research literature lacks a full understanding of teacher conceptions of their own strengths and weaknesses. Demands for data use march on, potentially creating a cumulative capacity deficit that will dig schools even deeper into confusion.

Summary

The research literature shows that data can represent different things to different people in schools. Data can be evidence of achievement as well as feedback on organizational processes. One's role in the organization may shape one's understanding and implementation of data-driven decision making. Data take on potentially different shapes to teachers in different content areas or of different instructional paradigms. Policy makers traditionally viewed student achievement on standardized testing as the most valid form of data for measuring school success. Under those regimes, schools may have been designed shelter teachers from external data. Today, however,

new accountability systems are forcing the alignment of teacher practice to external data, and broadening teacher evaluation to include many other measurements of teacher effectiveness.

Definitions in which data work within frameworks of continuous improvement and organizational learning are suitable for exploring teacher conceptions of data through a constructivist lens. Such definitions, arising out of systems theory, are broader than definitions that focus primarily on student achievement. Therefore, they allow a wider view over teacher activities both inside and outside of the classroom. They are also more responsive to many activities in which teachers engage, but which might fall outside of narrower definitions.

Factors of sensemaking, organization, politics, and capacity and structures contribute to different teacher responses to mandates for data use. Individuals engage in sensemaking from multiple starting points, and with a variety of partners. Teachers must make sense of mandates for data use. Their evaluations depend on their and their evaluators' use of data. Teachers also potentially make sense of data through their content areas. English and mathematics teachers may assess and value different kinds of data. Lastly, constructivist teachers may generate data that is very different from their behaviorist colleagues', or from other constructivist teachers'.

As policy changes, calls for data-driven decision making in schools change. The 21st century has seen a growing emphasis on data use in schools, and has forced a change in the organization of schooling. The once-isolated teacher, protected within four classroom walls by a central office that actively sought to decouple external measurements from the evaluation of teacher practice, now finds that evaluation and other mandates force direct alignment between everyday classroom practice and external data. Research has shown that district and school leaders have a role to play in preparing teachers to participate in this new regime. Forging contexts for true joint work in organizational learning contexts, however, is tough work.

Teachers and schools may currently lack capacity for this work. Research has shown that teachers do not always know what to do with data, even after extensive training. Even if they know what to do, they often lack the time and tools to do it. In the midst of this confusion, policy makers and researchers call for more and more data to flow into the classroom, and into teacher practice.

Research literature has provided some insight into normative cases and useful technologies. It has even sought to connect student outcomes to specific data-driven decision making projects. There is no broad understanding of how teachers perceive and use data, and little discussion of how differences between settings and content areas affect all of that. There is no typology of data that considers teacher perceptions, and no matrix to qualify effectiveness. This study hopes to make a contribution in those areas.

CHAPTER III:

Methodology

This study arose from a pilot case study conducted in the Spring of 2011 exploring math and English teacher perceptions of data-driven decision making in Eagle High School, a high-performing suburban high school in New Jersey. The pilot study not only showed that the design was sound and would scale to a comparative case study of multiple sites, it also provided data that I have carried into this study. I describe my methodology for the current study below, and include the following descriptions: overall design, settings, sampling, data collection and analysis, role of the researcher, issues of validity and reliability, and limitations.

Overall Design

Focusing on teacher definitions and descriptions, this comparative case study views the central phenomenon of data-driven decision making as the unique construction of each participant within social contexts (Creswell, 2007). Qualitative methods provide rich descriptions of such contexts, and the interactions within them, toward the development of theories or patterns of meaning (Creswell, 2007). Qualitative research therefore aims to understand social phenomena by listening to their participants (Firestone, 1987). I hope that this study can inform implementations of data-driven decision making projects by describing some of the perceptions and behaviors of secondary teachers in tested subject areas.

Since the research literature on teacher perceptions and use of data-driven decision making is thin, I take an *a posteriori* rather than an *a priori* approach (Patton, 2002). Discussions

with teachers and examination of the professional literature that they and their administrators and supervisors cite as important to their implementations of data-driven decision making allow me to understand their beliefs. Patton (2002) notes that qualitative research lends itself to such inductive inquiry.

A comparison of teacher perspectives requires that I collect rich contextual data from multiple participants. A comparative case study design proved to be the best fit. Creswell (2007) defines a case study as inquiry in which a researcher examines an issue “through one or more cases within a bounded system (i.e., a setting, a context)” (p.73). My conceptual framework poses contextual factors as potential influences on data-driven decision making. Yin (2003) notes that case studies are well-suited to exploring phenomena within their contexts, particularly when there are not clear borders between phenomena and context. A full exploration of context, however, requires multiple settings.

Settings

The settings are specific—three New Jersey high schools in separate districts that identify themselves through strategic planning documents and/or through affiliations with organizations as practicing or desiring to expand the practice of data-driven decision making. For the purposes of this study, I define “high school” as any school serving grades nine through twelve, and operating within a district subject to accountability under the New Jersey Department of Education. In selecting my three sites, I also sought variability across several facets: size, district organization, and socio-economic status. Each of these facets presents different challenges and impetuses for data-driven decision making projects, particularly through the organizational and political facets of my conceptual framework. The settings, then, are high schools that each show “interesting” involvement with data-driven decision making through their statements and

affiliations. They each exhibit qualities of structure and/or demographics that might interact in ways to effect teacher implementation and perception of data analysis projects.

One site operates in a regional high school district. N.J.S.A 18A:13-34 allows boards of education to create a limited regional school district with a separate board of education and administrative structure to provide a high school. Students from multiple separate K-8 districts therefore gather in ninth grade into such regional high school districts. While there is no written history of regional high school districts in New Jersey, one such district outside of this study describes the reasoning:

The primary goal of creating the new regional high school district was to provide a high quality education for students in a 150 square mile area of Hunterdon County, who were previously served by smaller and older high schools lacking the facilities to handle rapidly-growing student populations and the programs needed to offer the broad-based curricula. (Hunterdon Central Regional High School)

Including a regional high school among my settings allows me to explore whether such districts experience articulation pressures that do not exist or express themselves differently in K-12 districts. Students from multiple K-8 districts moving into a regional high school district might, for example, present with different kinds of data, different scores measuring achievement against different K-8 curricula, and more.

All three schools operate in different socioeconomic contexts as indicated by their district factor groups (DFG). In 1975, the state of New Jersey developed the DFG methodology to classify like districts into “district factor groups” based upon six variables linked to socioeconomic status (New Jersey Department of Education, 2004). The resulting scheme provided ten classifications, A at the lowest socioeconomic end through J at the highest (New Jersey Department of Education, 2004). At this writing, the New Jersey Department of Education is moving from this scheme toward classification of districts into peer groups through propensity

matching (New Jersey Department of Education, 2012). When data collection for this study occurred, however, the DFG classification methodology was still in place.

By examining schools in different district factor groups, I hope to explore different accountability and other pressures that might impact upon data-driven decision making. Federal grants and programs, public perceptions of achievable growth in student performance on state assessments, and requirements for schools chronically determined to be “in need of improvement” may all work through my conceptual framework to influence teacher perceptions and practice. Schools in my study present at DFG’s I, GH, and B.

Raven High School is a small high school in a K-12 district in northern New Jersey. The district’s DFG is I, indicating high socioeconomic status. RHS is a comprehensive high school serving roughly 600 students in 2011-2012 in a town of just under three square miles, with a population under 15,000. Achievement is high, with 96.1% of students passing the state language arts and 90% passing the state mathematics examinations in 2011-2012. The community is well-off and well-educated. Its three census tracts range in 2010 median household income from \$84,000 to \$103,000, with the majority having achieved post-secondary education levels.

Unique among this study’s sites, RHS houses its district’s central office, which sits within earshot of classrooms. District administrators, including a curriculum director and supervisors for math/science and humanities, have easy access to high school teachers. When I visited the school, the superintendent had been on the job less than one year. The curriculum director had served as the acting superintendent just prior to his arrival. The curriculum director described herself as a proponent of data-driven decision making. The district’s five year strategic plan, reaching its final year, included strategies for enhancing data-driven decision making

through technology (particularly in documenting and reporting on alignment to standards through curriculum mapping) and assessment.

Eagle High School is a much larger school, with a 2011-2012 enrollment of 2,100 students. Operating in a suburban community in central New Jersey, EHS is similarly high performing, with 97.1% and 92.4% passing the 2011-2012 state assessments in language arts and mathematics, respectively. EHS is one of several high schools within a regional high school district, and accepts ninth graders from multiple K-8 districts. These feeder districts range in DFG from CD on lower end to I on the higher end. The larger regional district in which EHS operates, however, falls into the GH district factor group. The town has a population of about 36,000 living within an area just under 40 square miles. The majority of the high school's students live within this town. The town's census tracts have 2010 median incomes between \$64,000 and \$103,000, with the majority of the tracts above \$100,000.

Prior to my visit, Eagle High School had applied for and been accepted to the New Jersey Department of Education's "PLC Lab School" program. The New Jersey Department of Education (2006) had worked with the Educational Information and Resource Center (EIRC) to recognize thirty-three schools as exemplars in their implementations of professional learning communities. Professional learning communities are communities of practice that depend upon collaborative analysis of data in an inquiry-based, organizational learning context (Dufour & Eaker, 1998). The school's acceptance into the PLC Lab School program was based in large part on its own articulation of its use of data.

Hawk High School served 1,000 students in 2011-2012, and operates within a DFG B K-12 district. The town surrounding the high school has a population of roughly 27,000 spread across 62 square miles. The 2010 median income in this town is \$45,000, with few of the

residents having advanced beyond high school. Achievement at HHS is substantial, given its socioeconomic challenges. On the 2011-2012 state assessments, 88.1% of HHS students passed in language arts, and 72.6% passed in mathematics. At these levels, however, HHS has been designated by the New Jersey Department of Education as lagging behind its peers, having achieved higher than just 20% of schools statewide, and 45% of schools with similar demographics. (Raven High School outperforms 60% of schools statewide, while Eagle High School outperforms 71% of schools statewide.)

The strategic plan for Hawk High School's district highlights the use of "data proven decisions" to offer curricular opportunities to all of its students. To that end, the district contracted with the Northwest Evaluation Association to administer the Measures of Academic Progress (MAP) assessment to all ninth and tenth grade students. MAP is a computerized adaptive assessment designed to provide timely and actionable data to educators (Northwest Evaluation Association).

Created by educators for educators, MAP assessments provide detailed, actionable data about where each child is on their unique learning path. Because student engagement is essential to any testing experience, NWEA works with educators to create test items that interest children and help to capture detail about what they know and what they're ready to learn. It's information teachers can use in the classroom to help every child, every day. (Northwest Evaluation Association)

Hawk High School was the only site in this study administering a nationally-validated common benchmark assessment to high school students at the times of my visits.

Two schools shared a distinction with regard to data-driven decision making. The sitting superintendent over Hawk High School and the recently-departed superintendent over Raven High school were both active in the New Jersey Network of Superintendents. Organized through the Panasonic Foundation, the New Jersey Network of Superintendents provides professional

development for educational leaders, exposing them to data-driven protocols designed to measure progress toward goals grounded in equity (Hatch & Roegman, 2012). The Panasonic Foundation's "Six Key Leverage Points" owe much to systems theory and continuous improvement, relying upon data-driven decision making for tracking progress in contexts of organizational learning (Kronley, et al., 2010).

Research Sample

For this study, I identified six teachers (three mathematics and three English) in each school through a mix of snowball and criterion sampling (Creswell, 2007; Patton, 2002). Administrators and supervisors in each school recommended participants whom they believed to be experts in data analysis. This study limited the sample to teachers of mathematics and English because those are the only two subjects that were tested in the High School Proficiency Assessment, New Jersey's high school exit examination. This focus allowed me to study teachers who, while potentially using a wide variety of data, would likely be under directions to use test data to plan their instruction.

Administrators and supervisors were also invited to participate in the study. In Raven High School, the math/science and humanities supervisors participated, along with the district curriculum director. In Hawk High School, the principal participated, along with a special education supervisor. No administrators or supervisors opted to participate in Eagle High School.

I collected ethnicity and other demographic information to understand participant representation of the larger staff in the three schools. Participants were not, however, meant to be representative in this way. The research questions did not require this kind of variability. I did not disqualify or seek participants for any demographic quality—years of experience in the profession, gender/ethnicity, courses taught within their subject areas, etc. The sampling strategy

was designed to provide a view into a “what’s possible” scenario for data-driven decision making in each school, while still remaining respectful of and attentive to local definitions of effective practice. The mix of snowball and criterion sampling, relying upon school leaders to recommend participants based upon perceived expertise in data-driven decision making, was meant to ferret out the atypical cases in each department.

The table below summarizes the participants, including their department/role and setting. I include sex only for reference.

Table 1

Participant Information

Pseudonym	Department and Role	Sex
Raven High School		
OT	Math/Science Supervisor	F
TC	Humanities Supervisor	F
MK	Director of Curriculum	F
UX	English Teacher	M
BR	English Teacher	F
NN	English Teacher	F
EN	Mathematics Teacher	F
SD	Mathematics Teacher	M
SX	Mathematics Teacher	M
Eagle High School		
KQ	English Teacher	F
LE	English Teacher	F
DM	English Teacher	F
CH	Mathematics Teacher	M
EQ	Mathematics Teacher	M
FD	Mathematics Teacher	F
Hawk High School		
DW	Principal	F
DT	Special Education Supervisors	F
TX	English Teacher	F
SE	English Teacher	M
BT	English Teacher	F
EU	Mathematics Teacher	M
UE	Mathematics Teacher	F
SG	Mathematics Teacher	M

Data Collection

Case studies require multiple forms of information in order to achieve full descriptions (Creswell, 2007; Yin, 2003). In this study, I interviewed eighteen teachers, three mathematics and three English teachers in each school. I also interviewed two supervisors and a curriculum director in one school, and one supervisor and the principal in another school. In total, I conducted twenty-three interviews between April, 2011 and December, 2012. Documentation in each site served to build context for interviews by clarifying school and district goals and demographics, as well as providing artifacts of teacher practice. Finally, examination of professional literature from publishers cited by participants provided “textbook” examples of the practices and protocols that these schools were attempting to employ. These data contributed to a collection regime designed to achieve Strauss’ (1987) “theoretical saturation.”

Interviews. I conducted twenty-three interviews, each lasting between thirty and sixty minutes. Standardized open-ended interview protocols (Patton, 2002), one for teachers (Appendix B) and one for supervisors and administrators (Appendix C), focused conversation on the research questions. These protocols also helped to control length of each interview (Patton, 2002). This was necessary, as I interviewed each participant in a naturalistic setting during the workday. After each interview, I completed analytical memoranda and contact summary sheets in order to record any salient themes, nonverbal communications, or aspects of context and setting that might prove to be important but which might be lost to later analysis.

Interview questions for teachers and leaders focused on their descriptions of the practices and efficacy of data analysis in their completion of specific duties (assessment, lesson planning, etc.) and toward the fulfillment of school and district goals. Through these questions, I hoped to understand participant definitions of “data analysis” and “data-driven decision making” by

determining which practices they believed did and did not fit into those categories. The questions also sought information about structural, organizational, and political factors that facilitated or hindered teacher use of data.

I digitally recorded all interviews, and utilized a computerized platform to take notes during and immediately after each interview. I attached transcripts to these notes at a later date. These files were saved in a format that was compatible with the data analysis software.

Documentation. For each site, I collected federal, state and district statistics to understand several contextual factors—demographics of town and school, student achievement, district factor grouping, size, organization, and more. In addition, I examined each school and district web site for materials to indicate the role of data-driven decision making in school values, mission, and goals. District-level strategic planning documents highlighted data-driven decision making in two of three sites (Raven High School and Hawk High School). Neither Eagle High School nor its district had a strategic plan, but the school did have documentation on its acceptance into the New Jersey Department of Education’s “PLC Lab School” program.

I also collected several artifacts of practice at each site. In some cases, these documents were rubrics or other materials provided by teacher participants as illustrations of their work. Administrators and supervisors provided brochures of products that the school or district had purchased to assist in data-driven decision making (such as the NWEA MAP assessment). Administrators and supervisors also provided reports on school-wide data and achievement to illustrate the kinds of analysis that occurred.

Professional Literature. Participants identified specific pieces of professional literature that were useful to them as they implemented data analysis projects. The purpose of professional literature is to support practitioners in the field with information on new technology and effective

practices, while research literature involves peer review to convey research and ideas to researchers (Rutgers University Libraries). While study participants identified titles of works from various publishers and sources, two professional literature publishers were prominent: Corwin Press and ASCD. I examined catalogues from these publishers, and reviewed both recommended and prominent recent pieces. Teachers at Eagle noted the work of Richard and Rebecca DuFour, the husband and wife cofounders of Solution Tree.

Corwin Press is the professional literature imprint of SAGE. Corwin bills itself as “the premier publisher of professional learning resources that equip PreK–12 educators with innovative tools to improve teaching and learning” (Corwin). As of this writing, their catalogue offers thirty-six separate book titles covering the topic of data-driven decision making, published between 1994 and October of 2013, with all but two published after 1999. Ten of the thirty-six titles are marketed to teachers, and focus on specific practices, strategies, and protocols for use in the classroom and school. These include assessment strategies, RTI, action research, and professional learning communities—all of which were focus topics in the literature recommended by participants.

ASCD (formerly the Association for Supervision and Curriculum Development) is a nonprofit professional organization boasting over 140,000 members in education, representing 134 countries (ASCD). Their book catalogue does not list titles under a “data analysis” or “data-driven decision making” topic heading. As of this writing, however, a search for the keyword “data” yields 143 book titles. Specific ASCD titles recommended by participants focused on topics overlapping with those in the Corwin catalog.

Solution Tree bills itself as the “leading provider of educational strategies and tools that improve staff and student performance” (Solution Tree). The founders are credited with all but

inventing professional learning communities. Their catalogue now branches into a wide range of topics such as Common Core State Standards alignment, brain-based learning, and 21st century skills. They do not list a category for data-driven decision making in their catalogue, but a keyword search for “data” yields 14 titles. For this study, I chose their 2006 handbook meant to accompany their seminal 1998 work on professional learning communities, as participants cited this publisher’s work on this topic as relevant to their data analysis practice.

This study views recommended professional literature in the aggregate. The professional literature typically positions data-driven decision making either as its own practice, or as a key practice in service to a larger implementation (e.g., action research or professional learning communities). I was able to use this literature to conceive of a fictional and, as that literature would possibly describe it, “perfect” fourth site in which all implementations of data-driven decision making are successful. This foil to the three research sites is based on a limited sampling of the professional literature, but its relevance is high. Table 2 summarizes the pieces of professional literature that I analyzed for this study.

Table 2

Professional Literature

Publisher	Author(s)/Editor(s)	Publication	Title
Corwin	Love, ed.	2009	<i>Using Data to Improve Learning for All</i>
Corwin	Creighton	2007	<i>Schools and Data: The Educator’s Guide for Using Data to Improve Decision Making, 2nd Ed.</i>
ASCD	Schmoker	2006	<i>Results Now: How We Can Achieve Unprecedented Improvements in Teaching and Learning</i>
ASCD	James-Ward, Fisher, Frey, & Lapp	2013	<i>Using Data to Focus Instructional Improvement</i>
Solution Tree	DuFour, DuFour, Eaker, & Many	2006	<i>Learning by Doing: A Handbook for Professional Learning Communities at Work</i>

Data Analysis

In qualitative research, form follows function—which is to say that the purpose, the researcher, the questions, and the framework determine the most appropriate processes for analysis (Creswell, 2007; Miles & Huberman, 1994; Patton, 2002). While there is no one recipe for qualitative data analysis, researchers accept certain ingredients as staples in rigor. I utilized specific strategies in an analytical process designed both to examine data through the lens of the framework, and to remain flexible enough to incorporate emergent themes and ideas.

Early analysis commenced at the conclusion of each interview through the use of contact summary sheets (Miles & Huberman, 1994). I completed these sheets within Evernote, the same computerized note-taking platform that I used to record field and other notes in each site. I coded each summary sheet to set the stage for later microanalysis. Coded document summary forms (Miles & Huberman, 1994) accompanied any artifacts that I took from interviews. I later added interview transcripts to summary sheets and notes in Evernote, and moved all of these data into the free and open-source TAMS (Text Analysis Markup System) application for coding and analysis.

Miles and Huberman (1994) note that data collection is a “selective process” (p. 56), and suggest that frameworks provide some of the best preparation for analysis. The framework for this study presented broad categories that served as a “start list” (Miles & Huberman, 1994, p. 58) of codes. Early analysis (Miles & Huberman, 1994) and microanalysis (Strauss & Corbin, 1998) of interview transcripts led to second level coding, revealing emergent themes that dialogued with the framework.

Lofland (1971, cited in Miles & Huberman, 1994) and Strauss (1987) suggest participants’ practices as a possible target of coding. In addition to codes derived from the

framework, I identified specific practices. I examined co-coding in transcripts between these practices and other codes to reveal variations in practice related to content area or other aspects of the framework (capacity, structure, sensemaking, and more.). This allowed for an analysis of the differences in practice between English and mathematics teachers, and also led to the continuum discussed in Chapter IV, and the typology advanced in Chapter V.

Coffey and Atkinson (1996) contend that decontextualizing and recontextualizing data through coding helps the researcher to think both “about and with the data” (p. 31). I utilized tools in TAMS to query for, aggregate, and visually represent relationships between coded data segments. I also utilized Microsoft Excel to perform basic calculations on frequencies of codes. Lincoln and Guba (1985, cited in Miles & Huberman, 1994) recommend coding and recoding to achieve saturation and to identify regularities. Through this process, I developed and applied interpretive and pattern codes (Miles & Huberman, 1994) that reached deeper into my data. Such codes led to themes and, ultimately, assertions about teacher recognition and acceptance of various data-driven decision making practices. I then developed maps and matrices to illustrate relationships in the data. Such analytical processes are important to the combination of extant and emergent themes into theory (Coffey & Atkinson, 1996; Patton, 2002).

Role of the Researcher

My role at one of the sites, Eagle High School, must be clarified. Eagle High School operates within the district that employs me. My tenure in the district began in 1995, when I was hired as a social studies teacher. I worked in several district schools, but never in Eagle High School, nor under the supervision of any of its administrators or supervisors. In 2004, I moved into the district office as an Administrative Supervisor for Curriculum and Instruction, a twelve-

month district-level position. I occupied this position when I conducted interviews for my pilot study, the data from which I utilize in this study.

As a district-level curriculum supervisor, I provided resources and professional development in many topics and practices, including the use of data to inform teacher decision making. There was little or no possibility of coercion of participants because: 1) I did not evaluate or supervise any of the individuals who were responsible for the implementation of data-driven decision making in the site, 2) I did not evaluate or supervise any of the participants on any practice relevant to the study, 3) I notified participants of their right to drop from the study for any reason and at any time, and 4) this study discusses data under pseudonyms for the site and individuals, or in general terms, with no identifying information. I adhered to Institutional Review Board (IRB) requirements for consent and disclosure. All participants completed a consent form (Appendix A), which included consent to record the audio of the interview.

Issues of Validity and Reliability

Miles and Huberman (1994) advance four criteria for evaluating qualitative research: credibility, transferability, confirmability, and dependability. I designed and mounted this study with each of these criteria in mind, and made conscious decisions on the design to ensure validity and reliability.

The triangulation of multiple sources is a time-honored and effective method for achieving credibility. One source is not enough to describe complex phenomena (Patton, 2002). This study relies upon several data sources, providing multiple data points for examination of themes. In addition, triangulation of multiple participants in similar roles across multiple sites

required themes to express themselves vigorously in order to present noticeable bumps in the data (Creswell & Miller, 2000).

Transferability measures a study's potential to describe conditions in similar settings (Miles & Huberman, 1994). This study's conceptual framework, built from research literature arising from studies in similar settings, served as the touchstone for all design decisions. The findings have relevance to all of those settings. In addition, this study utilized multiple research sites, the selection of which sought to create sufficient variability in size, socio-economic status, and organization to guarantee transferability, at least in New Jersey. The triangulation of sources across multiple sites and through multiple participants in similar roles also strengthens transferability (Miles & Huberman, 1994).

Researcher bias may threaten confirmability, even without the knowledge of the researcher. The data collection and analysis plans in this study include several safety valves to deal with this possibility. Coding proceeded at the immediate conclusion of each interview to ensure that the conceptual framework rather than any bias served as the foundation for analysis. Member checking ensured that transcripts captured what participants intended to say. All data, from recordings to coded transcripts, are available for review.

Dependability is always a concern in comparative case studies attempting to capture and draw connections across the chaos of social contexts. In this study, clear research questions flowed through a conceptual framework that served as a touchstone for all decisions during the design and mounting of the study. The questions and framework indeed drove that design, ensuring congruence. The framework determined the settings by posing the specific aspects of organization, structure, and accountability that would serve as factors for selection. The

questioning protocols and coding flowed from the framework's categories. The framework also guided the analysis and presentation of findings.

Miles and Huberman (1994) discuss the three-year documentation and design process for a major study. While a dissertation often takes longer than students and advisors intend, and probably longer than loved ones were led to believe through efforts to secure their support, timelines and scope render such documentation impossible. That said, the methods and findings in a dissertation must be able to survive rigorous examination. In the dissertation, however, short timelines and competing priorities can create cracks through which bias and sloppiness seep. A broken thermometer, after all, is always reliable but never valid (Miles & Huberman, 1994). A dissertation's clear questions and solid framework go a long way toward rigor in design, but only if the researcher continues to return to those questions and that framework, and complements them with strategies designed to preserve both reliability and validity.

Limitations of Methodology

No administrators or supervisors from Eagle High School participated in the study. Since the interview protocol asked teacher participants to discuss factors in the school that facilitated or hindered their use of data, and since Eagle High School teachers cited supervisors and administrators in answers to both questions, the lack of an administrative voice from this site is a limitation.

This study did not uncover the consensus of all teachers in all three sites to determine whether the practices described by participants had significant penetration, whether artifacts discussed were standard or even typical, and whether there was widespread awareness of the professional literature cited. Following up on the interviews with a survey of the entire teacher

population (or, at least, the entire math and English departments) might have provided information on whether participant experiences and perceptions were typical of others in the site.

The sampling design relied upon supervisory perceptions of effective data use, and did not provide criteria. The perceptions were highly subjective. Schools are currently turning the corner toward more data-rich evaluations of teacher practice. While many argue the validity of various student achievement measures to describe teacher effectiveness, evaluation of that effectiveness nonetheless dominates discussions in New Jersey.

The lack of a normative definition of “data” and “data-driven decision making” in the research literature, and the dearth of common language for data analysis in practice, is one factor in considering the impact of these limitations. Variation within a school would show inconsistencies of thought between the recognized experts in different departments, or even different classrooms. Variation between sites would perhaps have flowed from different factors of size, organization, or accountability. In all cases, variation is a valuable finding, and would provide springboards for future studies.

This study’s framework attempts to describe the individual teacher’s sensemaking of data-driven decision making. In this description, the individual teacher’s construction of meaning is influenced but not dominated by social interactions. Likewise, the nature of those interactions is influenced but not dominated by issues of organization, politics, structure, and capacity. Administrators and supervisors at Eagle High School did not present for interviews, but they did choose those teachers whom they believed to be expert data analysts. The teachers interviewed in all three sites may not be typical or represent consensus, but they are sensemakers of data-driven decision making who must work through issues described by this study’s framework to reach their conceptions.

The study of teacher sensemaking of data-driven decision making is new. My research questions hope to provide information on the processes at work in, around and upon teacher thinking. At the end of the day, all teachers must implement policy and mandates as they move into new data-driven evaluation systems. My hope, however, is that this study can shed light on the perceptions of those whom our school leaders perceive to be experts in data analysis. If their perceptions of data-driven decision making are not aligned to those of evaluators and policy makers, then we must be ready for a rocky road to rise to our wheels over the next several years.

CHAPTER IV:

Findings

This study asks how English and mathematics teachers describe data-driven decision making. The analysis shows that teachers characterize the data they use by its formality, which is related both to the source and the perceived usefulness of the data. Teachers feel that they have less control over more formal data from sources outside of their classroom. This more formal, external data is less useful to them.

Teachers cite students and time as the chief obstacles to data-driven decision making. A selection of relevant professional literature presents a normative case, a perfect school in which common understandings mitigate questions about formality and usefulness. There are obstacles in the perfect school, but also specific remedies operating within a larger structure of action research or professional learning communities that nullify any ill effects.

Formality

Teachers' descriptions of their data analysis practices vary along a continuum of formality. Data are formal when there is a standard way to collect and analyze them. The most formal data often come from external measurements, such as standardized assessments. Teachers collect informal data in their own classrooms with their own assessments. The most informal data are not standard in that there are no rubrics, taxonomies, or other tools assigning meaning to the data. Informal data are not likely to be abstracted into representations, or exposed to statistical or other mathematical manipulation. A teacher measuring student engagement, for

example, does not record each student's body language and map the observed postures against a chart to arrive at an overall score. Rather, that teacher takes a quick read of body language from a potentially small number of students and generalizes the level of engagement of all students in the room. In between the most formal and most informal ends of the continuum, teachers may work together to develop and analyze student achievement on common assessments, either opportunistically (and thus more informally), or on calendars of major assessments set by their supervisors and administrators (more formally).

Formality, control, and teacher descriptions of usefulness. Formality and control are, strictly speaking, separate variables. However, teachers believe that they have less control over more formal data. When they have complete control, they tend to describe the data and practice as informal, even when an outside observer might notice some elements of formality. I can map formality against control to describe categories of practices that teachers describe. Figure 2 identifies points of teacher practice with data on a continuum of formality, and maps them against a comparative level of teacher control over data collection and analysis.

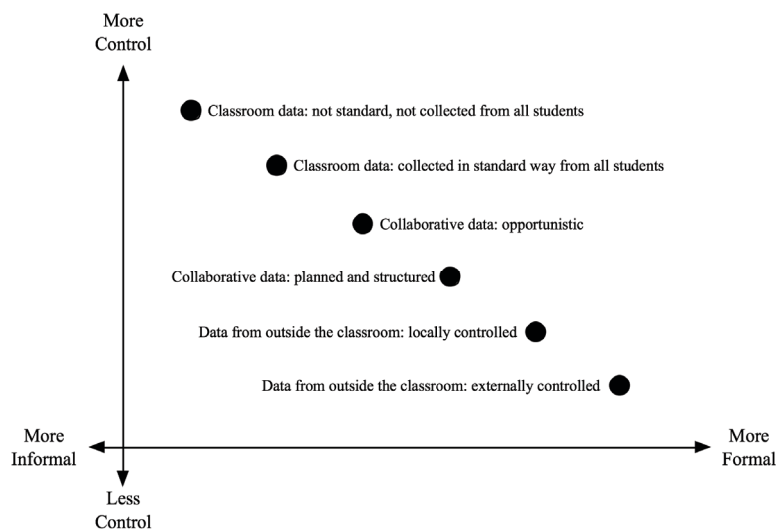


Figure 2. Data and data analysis formality mapped against teacher control.

Interestingly, teachers consider practices at the informal end of the continuum to be more useful to them. As formality increases, usefulness tends to decrease unless the data agree with what teachers believe they already know about their students. Supervisors and other “go-to” people can play a role in helping teachers see the usefulness of more formal data, particularly when they can simplify complex data and translate analysis into specific directions for teachers to follow in their planning. Despite these individuals, however, the overall trend represents an inverse relationship between usefulness and control. When teachers have more control over the collection and analysis of informal data in their classrooms, they tend to find the data to be more useful. As control moves from their hands—through technology, common assessments, or standardized assessment—the data become more formal, and are described as less useful.

The frequencies of descriptions and numbers of teachers at each point vary across sites and between content areas, but there is a predominance of more informal classroom data. Hawk utilizes the Northwest Evaluation Association (NWEA) Measures of Academic Progress (MAP) assessment, resulting in a higher frequency of descriptions of locally controlled standardized assessment data across more teachers in that site. The other two schools do not administer externally-developed assessments in a locally-controlled context, or do not require their teachers to access and analyze data from such assessments. All three sites are subject to externally-developed assessments. Table 3 summarizes the frequencies of coding for and numbers of teachers describing practices at each of the six points on the continuum, by site and content area.

Table 3

Formality: Frequencies of Codes and Numbers of Teachers

	Classroom data: not standard or from every student	Classroom data: standard and from every student	Collaborative data: opportunistic	Collaborative data: planned and structured	Data from outside the classroom: locally controlled	Data from outside the classroom: externally controlled
Sites						
Eagle	19, 6	38, 6	6, 4	2, 2		5, 3
Hawk	16, 5	21, 5	2, 3	2, 2	17, 6	4, 3
Raven	11, 4	13, 6	2, 2	4, 2		3, 2
All	46, 15	72, 17	10, 9	8, 6	17, 6	12, 8
Content Areas						
English	26, 8	42, 8	3, 4	2, 3	4, 3	4, 3
Mathematics	20, 7	30, 9	7, 5	6, 3	13, 3	8, 5

Note: Frequencies of codes and numbers of teachers listed as “frequency of codes, number of teachers.”

The next three sections describe teacher comments in each of the six points on the continuum. I start at the most informal end of the continuum with classroom data, and move through each point in increasing formality.

Classroom data. Teachers have the most control over data that they collect themselves, through assessments and other measurements that they design. The practices that teachers describe at the most informal end of the continuum help them know their students, either to create more engagement through an understanding of interests and hobbies, or to effect practice that is prescriptive to specific student weaknesses or that highlights specific strengths. On the more informal end, these measurements are not necessarily taken of every student, and are not often exposed to any protocol or formal analysis. Classroom data become more formal when teachers extend a standard measurement to all students, through polling, quizzing and testing, classwork, portfolio assessment, or exit questioning. Teachers also use rubrics to assist in more

formal analysis. Table 4 summarizes the frequencies of coding for specific practices that teachers describe on this end of the continuum.

Table 4

Practices with Classroom Data: Frequencies of Codes and Numbers of Teachers

Site/Content Area	Classroom data: not standard or from every student	Classroom data: standard and from every student
Eagle		
English	Knowing the Students (3,2) Diagnostic/Prescriptive Practice (2,2) Whole-class Discussion (2,2) Engaging the Students (2,2) Scan of Body Language (1,1)	Technology (7,2) Diagnostic/Prescriptive Practice (5,3) Quizzing/Testing (4,3) Engaging the Students (2,2) Polling (2,1) Portfolio Assessment (2,1) Rubric (1,1)
Mathematics	Scan of Body Language (3,3) Knowing the Students (3,1) Diagnostic/Prescriptive Practice (1,1) Whole-class Discussion (1,1) Engaging the Students (1,1)	Technology (4,2) "Do-now's" (3,3) Quizzing/Testing (3,3) Diagnostic/Prescriptive Practice (2,2) Exit Questioning (2,2) Polling (1,1)
Hawk		
English	Diagnostic/Prescriptive Practice (3,2) Engaging the Students (3,2) Scan of Body Language (2,2) Whole-class Discussion (2,1) Knowing the Students (2,1)	Rubric (5,2) Diagnostic/Prescriptive Practice (2,1) Knowing the Students (2,1) Engaging the Students (1,1)
Mathematics	Scan of Body Language (1,1) Diagnostic/Prescriptive Practice (1,1) Whole-class Discussion (1,1) Engaging the Students (1,1)	Diagnostic/Prescriptive Practice (4,2) Knowing the Students (3,3) Classwork (2,1) Quizzing/Testing (1,1) "Do-now's" (1,1)
Raven		
English	Scan of Body Language (1,1) Diagnostic/Prescriptive (1,1) Engaging the Students (1,1) Knowing the Students (1,1)	Quizzing/Testing (4,2) Diagnostic/Prescriptive Practice (2,2) Knowing the Students (1,1) Whole-class Discussion (1,1) Portfolio Assessment (1,1)
Mathematics	Diagnostic/Prescriptive Practice (2,1) Knowing the Students (2,2) Scan of Body Language (1,1) Whole-class Discussion (1,1) Engaging the Students (1,1)	Diagnostic/Prescriptive Practice (2,2) Knowing the Students (1,1) Technology (1,1)

Note: Practices listed in descending order by frequency as "Name of Practice (frequency, number of teachers)."

The informality of this third of the continuum does not mean that teachers do not give considerable thought to these data, or that the analyses are not important to them. CH at Eagle, for example, has developed a hypothesis around these data, wondering if students lose achievement during busy extracurricular seasons, a hypothesis that was even validated by “a national study.” DM, also at Eagle, includes such information about students on a list of data points that are important to collect, but confirms that the collection is very informal.

So I think it’s really taking time to really listen to what kids are talking to in the hallways, to develop a rapport, and that’s all informal data but it’s perhaps the most important data there is, because once you know that, it builds on everything else.

Many teachers see the best application of these data as highly opportunistic and anything but methodical—knowing a favorite sports team in order to make a classroom problem more engaging for a struggling student, for example. This is very different from an exercise in which teachers work collaboratively to develop assessments based on prior student achievement against a curriculum, or pore over cluster scores from a standardized test to pinpoint necessary interventions.

Teachers also describe scans of body language to determine if students are following along. Though they consider this a valid approach to diagnostic/prescriptive practice, they do not imagine it as formal data-driven decision making, even when they impose structure and quantification to the measurement. LE at Eagle, describing polling students by asking them to raise their hands, laments: “It seems that, these days, the number of hands would not be OK because it feels like we are forced to always test, test, test.”

Teachers consider classroom measurements to be more formal when technology is involved. Technology is one of the distinguishing practices between the first and second points

on the continuum. At Eagle, particularly in English, there are several technology solutions that teachers use in the collection of classroom data. FD discusses remote responders that allow students to submit answers to a digital whiteboard, the software for which collects and tabulates those answers for teacher analysis.

Those are pretty cool. And it's definitely a data-driven thing. And I like it because it gives immediate feedback ... And the students loved it because they got to see right away: "Do I know this? Do I understand it?" And not only do they see right away if they got it or not, but they can ask questions on it and understand it better.

LE, also an English teacher at Eagle, expands on how applications like these are valuable to diagnostic/prescriptive practice. "I can actually get a report of all the things that the kids are messing up on, and I can see if my lessons on writing in complete sentences actually paid off or not." Technology enhances speed and standardization of classroom data, both of which increase formality.

In all three sites, and in both content areas overall, teachers have a higher frequency of more formal rather than less formal practice with classroom data. English teachers describe more formal practices with and analyses of classroom data 63% of the time (35 of 56 total descriptions for these two points on the continuum). Math teachers describe such practices and analysis 58% of the time (23 of 40 total descriptions). Teachers' descriptions reveal that they use these measurements toward goals of knowing and engaging students in contexts of diagnostic/prescriptive practice. That is, they are diagnosing student weaknesses and prescribing specific remedies or adjusting lesson planning to address those weaknesses, sometimes leveraging what they have learned about students—favorite sports teams, for example—to enhance engagement.

At this end of the continuum, more English teachers discuss strategies to engage students than mathematics teachers, and at higher frequencies (10 instances in English, as opposed to 3 in

mathematics). Though engaging students is not a data analysis practice on its own, teachers describe relationships to data-driven decision making. When data analysis through diagnostic/prescriptive practice shows that students are falling short of a teacher's objective, English teachers in this study are more likely than math teachers to leverage and measure engagement as a remedy. In DM's classroom at Eagle, for example, analysis of results from a digital whiteboard activity showed that students were having difficulty understanding the iambic pentameter of the prologue of *Romeo and Juliet*. She turned to an activity in which students examine the meter of rap music. However, these teachers do not discuss additional data analysis to determine if their new, more engaging strategies are successful at enhancing student achievement. The heightened engagement, it seems, is the result that signals the success of the strategy. Teachers are looking for and measuring an increase in interest.

Sometimes, student confusion is part of the objective, and therefore measured. At Raven, UX presented his journalism students with a controversial situation. When his informal data analysis of classroom discussion indicated that the students had reached a desired level of dissonance, he moved into discussion and writing in which students placed themselves into the situation to describe their own reactions and beliefs. "The questions weren't right and wrong questions. They were ethical questions ... It wasn't about the right or the wrong answer. It was about thinking."

English teachers do not believe that this approach is even possible in math. KQ at Eagle describes the difference between the content areas in this way:

You can't teach kids a formula in English and like, "Wow, you are going to be amazing! You are going to be an honors English student!" In math, you can teach those little basic facts and build and they get that and they move on ... [English] is very different from any other subject. It's absolutely much more labor intensive. And some people might say it's somewhat more subjective. But "good"

is not subjective and that's what they have to leave here with, in my opinion anyway.

Math do not disagree, and several are quick to discuss perceived personality differences between English and mathematics teachers. SX at Raven describes math teachers as having “autistic” predispositions in comparison to their “humanities brethren.” EQ at Eagle predicts that English teachers “shut down if you give them graphs.” Math teachers, in general, feel that it is much easier for them to collect data, and equate data to the currency of their content area: numbers and statistics.

Usefulness. As data become more formal, even on this informal end of the continuum, teachers react with criticism. Some teachers are concerned about the validity of data from technology solutions, for example. Technology reduces a teacher's control by imposing standardization and protocols over the collection and analysis. Teacher concerns revolve primarily around the seriousness with which students approach these activities, and may also be reactions to the loss of control. Technology, they say, is blind to certain realities of classroom management that teachers account for (or simply ignore) in their less formal data collection. One technology-based reading solution at Eagle scales its activities based upon ongoing measurements of student performance. DM describes “crafty” students who know how to game the system. “If they purposefully get everything wrong ... their articles will be easier. If they take it seriously, it's great.” At Raven, one math teacher describes students who view an online summer math assignment as perfunctory and disconnected, therefore threatening its validity as a pre-assessment. “It's not part of their curriculum, so they're just, ‘Oh, I gotta do it.’”

Teachers who criticize movement toward more formal data collection and analysis are not apologetic about the weaknesses of their more informal approaches. Indeed, quite the opposite—they consider themselves in possession of experience and intuition that are much more

valuable. UE at Hawk, for example, knows from “all my years of teaching” where students are likely to stumble, and where they will need extra instruction. BT at Hawk goes further in trumping analysis of formal data with experience, asserting “I’m reading some of their stuff, going ‘I know this student’s gonna pass.’” KQ at Eagle was even more confident in her prescience:

I think that I read kids pretty well, between what they are doing when they are sitting in front of me, what their grades are looking like in front of me, what their strengths and weaknesses are. I would be willing to bet you, I can predict what these kids are going to do in college or not do in college.

Teachers are proud of this intuition. DM at Eagle believes that parents are also relying on it. In parent/teacher conferences, she says, “98% of the parents just want to know what we know as a gut reaction.” Parents can see standardized testing data, but need teachers to leverage intuition, experience, and content expertise to provide truly useful insights. It is a gift, a mysterious sixth sense.

Intuition and experience even allow teachers to take sophisticated readings on the fly. Teachers distinguish this from data analysis, however, even if the scans result in counts or involve, for example, paced measurements of the progression of a classroom discussion. Consider SE at Hawk, who brings experience to bear upon a scripted opening conversation in a philosophy course, a discussion that requires considerable monitoring to ensure a desired effect and provide useful diagnostic data:

I’ll purposely make the conversation abstract just to see who’s following, who’s getting it, and who doesn’t know what the hell we’re doing. And I just watch the conversation unfold. I see who’s raising their hand, who’s participating, and who’s putting their head down at that point. And then, toward the end of the class, I explain why we had this conversation and I say, “Don’t be frustrated, I’ll teach you how to think abstractly. I will teach you how to put abstract thoughts into concrete sentences and how to use concrete examples to make abstract points.” But, you know, right away I could see some people aren’t gonna get this as readily as others.

SD at Raven puts it much more succinctly. “Sometimes it hits you right in the middle of the forehead. You know it when you get blank stares.” Several teachers describe the same phenomenon, and attribute their ability to read it to experience and craft. Reading body language is a skill that teachers hone. It can be quite sophisticated, as in the opening discussion in SE’s philosophy class, but teachers do not consider it to be formal data-driven decision making. It does not look like, nor does it serve the same goals as, structured and formal analysis over standardized testing scores provided by their supervisors, or with common assessments they develop with colleagues.

Collaboration. Collaborative data analysis requires standardized data between teachers. It may involve data that teachers collect in their own classrooms, which affords teachers some control even if they must negotiate to develop the assessments and determine the best procedures for administration. Or, teachers may collect data on school goals related to culture and climate, but not related to their day-to-day practice in their classrooms. They may have less control over these data—survey data, attendance data, etc.—but the lack of control is not intersecting with (and therefore not threatening) their classroom practice. Collaborative data analysis is more informal when teachers convene opportunistically. It becomes more formal, and teachers lose more control, when supervisors and administrators convene teams and introduce data analysis protocols. Table 5 summarizes the frequencies of coding for practices that teachers describe in this section of the continuum.

Table 5

Collaborative Data: Frequencies of Codes and Numbers of Teachers

Site/Content Area	Collaborative data: opportunistic	Collaborative data: planned and structured
Eagle		
English	Knowing the Students (1,1)	Common Assessment (1,1)
Mathematics	Knowing the Students (3,2) Common Assessment (2,2)	Common Assessment (1,1)
Hawk		
English	Knowing the Students (1,1)	Common Assessment (1,1)
Mathematics	Common Assessment (1,1)	Common Assessment (1,1)
Raven		
English	Common Assessment (1,1)	
Mathematics	Knowing the Students (1,1)	Common Assessment (2,2) Technology (2,2)

Note: Practices listed in descending order by frequency as “Name of Practice (frequency, number of teachers).”

When collaborative practice with common assessments is more informal, a pair or small group of teachers convenes opportunistically to develop common assessments on units or other content, and may conduct brief data analysis to compare how students perform. Teachers may also come together informally to share existing data in order to learn more about their students, either individually or as a whole class. The practice becomes more formal as supervisors and administrators impose calendars, protocols, and purposes upon common assessments that teachers design from existing question banks or develop from scratch. Supervisors and administrators may intend to diagnose curricula and uncover student and teacher deficiencies

through analysis of student achievement on these assessments on a much broader scale than informal, ad hoc teams can reach. Formal collaboration is also a hallmark of Professional Learning Communities (PLC), the protocol-driven and highly-collaborative model of continuous improvement that is very prominent in the professional literature on data-driven decision making, and which teachers in all three sites use to describe their school's approach to assessment and data analysis. Teachers sometimes engage in formal PLC protocols with colleagues to understand results on major common assessments.

In this center section of the continuum, teachers may spend a lot of time developing assessments, but very little time in data analysis. NN at Raven discusses a structured exercise to develop standard literature units with common assessments, but describes follow-up data analysis that is very "casual." "Yeah, something like, you know, 'How did the students do? Do you think the story was accessible to them?'" At Eagle, these conversations also treat achievement data very quickly, and then move to discussions of practice. EQ describes comparing notes with a colleague.

They did pretty well, except for the fact that when they got to solving a simple equation, they did not know what to do.' And I'll say: "Yes, mine were the same way. Do you have any ideas for how to help with that? Do you have any special techniques?"

Both teachers are open to changing their practice, but the analyses leading them in that direction is thin compared to more highly structured, protocol-driven examinations of disaggregated cluster scores from standardized assessments. Here, teachers also volunteer the deficiency in practice rather than work through a protocol that exposes it.

Teachers describe more informal, opportunistic collaborative work as highly dependent upon collegiality. Several teachers at Eagle used the word "family" to describe the climate of their school. FD extends this notion to that of a professional ethic.

I think it's pretty much just the way that we do our work together. I mean, if I notice that my students are really struggling with something, I will go to another teacher and say: "You know, how did your kids do on this quiz or how do they do on their homework? Because I had to re-explain all of that and I don't understand why they did not get it." And if they tell me: "No, they did really well," I'll ask them: "How did you approach that? How did you teach it?" ... So, we really do feel it's a big community, a big family where we all feel comfortable with each other about, really, anything, whether it's for the students and their achievements or something that we're just personally struggling with.

The numbers of teachers and frequencies of descriptions in these middle points of the continuum are low, but there are some differences between sites and content areas. Teachers at Hawk, where a lot of data analysis occurs around more formal standardized assessments like the NWEAP MAP, are less likely to describe practices or analyses aligning to these two points. They describe attempts to develop common assessments that eventually fizzled, or conversations with colleagues that are more about concerns and fears than data. Overall, math teachers are more likely to describe practices and analysis in this section of the continuum. The mathematics curricula may be more widely and better articulated through these three schools, or the content itself may just lend itself more readily to common assessment. English teachers do not even describe common content.

Descriptions of collaborative practice are sometimes problematic. Teachers in all three schools confess to taking liberties in their administration of common assessments, even though they had participated in assessment development and may be expected to contribute results into a larger, collaborative analysis. SG at Hawk was the most forthcoming.

But I just look at [a common assessment] and I just tweak it to say, "OK, we did this," or "We didn't do that." And then there are times where I'll have a test and I'll see a question on it that I didn't look at completely when I first was given it, and I'm like, "We didn't really do it this way." So, I'll maybe make that a bonus question so that ... if you get it, you get extra points.

Usefulness. Whether or not teachers see the usefulness of data from collaborative work, they appreciate the time with colleagues. FD, mathematics teacher at Eagle, describes the collaborative work around these assessments as “the most rewarding thing” that they offer. When teachers draw value for their actual practice from these conversations, some suggest that the conversations reach conclusions that data, alone, cannot. SE at Hawk notes that the conversations with colleagues, presumably about qualities that data cannot express, “tell me more than a test score.”

The importance of particular individuals—“go-to people” and supervisors—is prominent in teacher descriptions of collaboration, and central to characterizations of collaboration’s usefulness. The presence of these individuals does not seem to have had much if any impact on the frequency of practices or numbers of teachers in this part of the continuum in any site. Teachers at Raven are quick to mention their colleague and fellow study participant, SX. Prior to becoming a mathematics teacher, SX worked for a major accounting firm in New York City. He has practiced mathematics as a specialist in ways that most teachers have not. His background has also equipped him to serve as an informal technology coordinator in this small school. Administrators and supervisors depend upon him to complete various state data reports. SX therefore has access to achievement and demographics data through NJSMART, a statewide data warehouse that no other teachers in this study had likely ever accessed. He also has the technical ability to move data between this system and the school’s student information system, thus creating aggregation and reporting opportunities for teachers and administrators that might not be available without him. Teachers value his openness with data, and his willingness to package it in meaningful and useful chunks. The curriculum director at Raven sounds appreciation for his abilities as well, and describes occasions on which SX correlated data from multiple sources, ran

complex formulas to determine confidence intervals and other statistically important features, and helped to pave the way to conclusions that had large impacts upon programmatic decision-making across multiple grades.

Supervisors figure prominently, as well. Also at Raven, mathematics teacher SD applauds his supervisor's efforts to bring data to bear on questions of vertical and horizontal articulation, helping teachers ensure that students are picking up where they left off, and are prepared for the next course. EN, another math teacher at Raven, describes how the same supervisor brought observation data from lower grade levels to the table in an attempt to focus collaboration on skills that high school teachers might need to address. English teachers at Eagle, a larger school, discuss the importance of their supervisor in data analysis projects. The supervisor shares time between two schools, and is sorely missed when she is not present to guide them.

Teachers at Hawk, on the other hand, discuss the absence of their supervisors in a different way. UE, describing a PLC meeting, admonishes her colleagues:

And, like, one of the teachers complained that there was no one overseeing his group ... And I said to him, "You're a professional. All the people in that room are professionals. You shouldn't need the supervisor to come in and tell you what to do." She can't be in four places at once. You know? So you have to agree as ... three or four professionals on something. You know? And it should be that way. I don't want to go to a meeting and have the supervisor telling me what to do. We should be able to work collaboratively and professionally.

Here, the teacher notes the absence of the supervisor in two different ways. First, one teacher is frustrated at the lack of any clear directions. UE, however, is thankful to have the freedom to use the time as she sees fit. This is very different from how teachers conceive of their supervisors' roles in the other two schools. At Raven and Eagle, supervisors serve a clear role for teachers, both to coordinate collaborative work around data (whether or not teachers immediately see

usefulness in the data), and to provide structure and focus to potentially overwhelming amounts of data.

Data from outside the classroom. Teachers also work with data that they do not collect, and over which they have little if any control. On the more informal side of this end of the continuum, teachers work with assessment or other data that administrators collect. More formal analyses occur with data from externally controlled standardized assessments, particularly those connected to accountability and prestige. These assessments include the College Board's Advanced Placement (AP) examinations and Scholastic Aptitude Test (SAT), by which many communities judge their schools, and New Jersey's High School Proficiency Assessment (HSPA), which determines various accountability responses from the state. Table 6 summarizes the frequencies of coding for practices that teachers describe on this end of this continuum.

Table 6

Outside Data: Frequencies of Codes and Numbers of Teachers

Site/Content Area	Data from outside the classroom: locally controlled	Data from outside the classroom: externally controlled
Eagle		
English		Standardized Assessment (2,1)
Mathematics		Standardized Assessment (2,2) Diagnostic/Prescriptive Practice (1,1)
Hawk		
English	Standardized Assessment (4,3)	Standardized Assessment (1,1)
Mathematics	Standardized Assessment (11,3) Diagnostic/Prescriptive Practice (1,1) Knowing the Students (1,1)	Standardized Assessment (3,2)
Raven		
English		Standardized Assessment (1,1)
Mathematics		Standardized Assessment (2,1)

Note: Practices listed in descending order by frequency as "Name of Practice (frequency, number of teachers)."

In Eagle, teachers use locally controlled data in a way that they may believe contributes to the school's goals, but which does not force changes in classroom practice. In that school, English teacher KQ describes various committees—the STAR Team and the Attendance Committee, for example—that work with organizational data on discipline, tardiness, and absenteeism. KQ does not participate in these committees, and so does not register an entry on Table 6. Her description is not sufficient for me to describe how teachers working on those committees actually use the data. However, she does believe that these teams have done well to identify students on the brink of losing credit due to absenteeism, or to build structures and expectations for students returning from a sentence in the district's alternative education program. That said, she is skeptical that “every little thing has to be sliced, diced and quantified.”

In Hawk, MAP scores dominate discussions of the use of locally controlled data. Math teacher EU describes the MAP test as an “in between kind of thing” with 9th and 10th graders that provides a benchmark of growth from the 8th grade state assessment and throughout the first half of high school. EU is able to determine not only individual strengths and weaknesses from the data, but also issues that may have organizational and articulation implications. He notes, for example, that the data indicate student skills with fractions to be a red zone for the district's math program. Despite potentially broad implications, however, EU does not feel that the MAP scores provide enough information for teachers to work together at data analysis. Neither does EU describe any change in his practice or planning as a result of seeing this issue in MAP assessment data.

MAP scores are also important measures for placement into remedial classes at Hawk. While teachers do not necessarily do the work of placement, or even set the MAP assessment cutoffs that trigger those placements, they have accepted the scores for this purpose. The scores

provide a formal rationale to teachers for student placement. When students complain about their remedial placement to UE, she cites their MAP scores. “You have to be here because of your MAP test. . . . There’s a cutoff and you didn’t reach that cutoff.” She does have the occasional student whose MAP score is an anomaly. She may agree that the student has been improperly placed, but feels powerless to change the situation. She notes that the extra work in math is probably good for the student anyway. In her higher level statistics course, MAP scores tell her if students are “really bright” and ready for statistics, as opposed to a review of basic math or geometry. MAP scores may therefore influence her planning, but at the level of course and unit planning rather than for differentiating instruction for individual students.

Other teachers use the MAP test in similar ways, equally general. In English, for example, TX will gauge a class’s vocabulary level from MAP achievement before choosing readings in unit planning. For the most part, however, Hawk teacher treat MAP assessment data almost as if it were the more formal type—outside data that are done to them, rather than data that they generate for informing their practice. They find uses—understanding and validating placement decisions, finding starting points for units, understanding class- or school-wide deficiencies—but describe few actual impacts on their practice.

Data that are imposed on the school bring more nuanced descriptions of practice. In Eagle, there is concern about school committees that go too far in responses to AP and SAT scores, as if manipulation of such data might be akin to playing with black magic. English teacher DM sits on a committee that has analyzed data around the school’s participation in and performance on Advanced Placement examinations. Based on that analysis, the school has attempted to increase the number of students taking examinations, but DM worries about a dip in average scores that may come with wider participation. State testing data, however, has its uses.

As Hawk teachers do with MAP scores, Eagle teachers examine state assessments scores of rising 9th graders to determine class-wide area strengths and weaknesses. EQ, a math teacher, is noteworthy in his description of this use, describing how his supervisor provides the data so that they can identify individual students who might require extra help or a “push.” Effects of these data do not, however, influence lesson planning or teaching. FD, another math teacher, goes a step further in distancing teacher analyses of these data from classroom practice. She notes that, in her experience, data imposed upon the school through state and other external assessments really only come onto the table in relation to accreditation reviews and other externally-pointed activities.

UE at Hawk describes a past use of state assessment tools—old writing prompts and state rubrics—to understand which students might be headed for trouble on the HSPA. Teachers would assign and then blindly grade essays written on those prompts, against those rubrics. This was perhaps an attempt to mimic some of the lack of control that teachers had over state assessments, but UE indicates that blind nature of the process eased some conversations with students who scored low on these benchmarks. “I didn’t give you the 2,” she would tell a student who questioned the grade. “Another teacher assessed you.” As with common assessments in Raven and elsewhere, however, the practice was discontinued. “Whatever,” UE notes. “So that was good. But that kinda fell through. You have to have people who have time to get together and pass everything around.”

Usefulness. Teachers generally do not believe that standardized assessments are relevant to their practice, and therefore feel that there is little usefulness in the data. They also have concerns about the accuracy of the data, primarily due to testing conditions or obstacles that students present, either through a lack of interest or through socioeconomic factors that

predispose them to be less prepared. The volumes of data, and the limited time to analyze them, combine with these concerns to present the image of teachers panning for gold through rivers of mud. EQ at Eagle says:

I think, a lot of times, we are asked to look at data and, you know, sometimes, I usually get a few things out of the data that are important but due to the time constraints, to focus on whatever it might be, I don't necessarily look at the whole. I might just ... pick a few pieces that I can use and then just focus on that.

This kind of thinking leads some teachers to deny the importance of these data altogether. KQ at Eagle gives little credence to student achievement on standardized tests, and is much more concerned about “what they are doing in front of me.” Discussing the NWEA MAP test, UE at Hawk is doubtful that the test “measures how students learn.”

Teachers discussing standardized testing data primarily describe analyses that administrators and supervisors arrange for them. Analyses are formal, and proceed with rules and through structures that teachers would not utilize themselves, or would rather utilize only when they feel that it is appropriate. Some teachers express that these sessions are a waste of valuable time or are redundant. LE at Eagle, for example, describes “analyzing again and again,” even though everyone already knows where the students will have trouble. “I know that even before they take the test, but I’m not going to teach to the test.” Teachers would prefer to approach these questions informally, making their own time to address them if they seem relevant. FD at Eagle would “rather spend that time doing something else, lesson planning ... or grading papers.” If she believes that data analysis is a valid response to a particular problem, however, she is willing to make time with a similarly inclined colleague. In this, we have an admission that a lack of time is not a constant and unwavering pressure, but is instead related to the importance of the activity in the teachers’ eyes. She is not willing to offer precious time to formal data analysis, but

is willing to make time if her expertise leads her to believe that data analysis is relevant and can proceed under her own rules.

Teachers also express fear and distrust when discussing data from outside of their classrooms. Hawk has the largest number of comments indicating fear and distrust, at nine. All six of the teachers at Hawk had at least one occurrence. Hawk, in the lowest DFG of the three schools, experiences challenges in students' readiness to learn that the other schools do not face. As teachers at Hawk register fear and distrust, they do so with a mix of concern for and fear of their students. Discussing complicated standardized testing questions in mathematics, EU worries that "there're people that are trying to get our students." At the same time, however, teachers at Hawk harbor a great amount of concern about how student performance will affect their school and their careers. UE worries that data analysis is the first step toward merit pay. As she discusses this fear, she describes an experience she had while sharing a library classroom space with an honors calculus class:

[The] teacher was working on the [digital white board]. All the kids had their graphing calculators. And then the next table was me with three boys ... who didn't pass the HSPA yet, and it was June. And they ended up never passing. And the librarian walks over to me and says, "What do you think of merit pay?" Just out of the blue. And, I mean... this is what I think of merit pay. Should I go home with these—? I mean, if I could get this one to stay out of jail, and this one to come to school and not kill anybody ... it's just not fair. And these kids over there, they're laughing and fooling around, having a good time, enjoying themselves ... because they love math and then there I am with—I can't get these three kids to graduate.

Distrust in the NWEA MAP test as an accurate assessment, and fear of improper decisions arising from those data, also run high at Hawk. The MAP assessment is an adaptive online test that scales question difficulty in real time based upon student responses. SG worries about the validity of the test and the seriousness with which students take it when some of his students reported questions on telling time. "I'm like, how many did you get wrong to get down

to ‘Can you tell time?’” SE, an English teacher, has firsthand knowledge of the testing environment:

I was assigned to duty in the library ... and I saw how the test was administered, how seriously the kids take the test ... Some of them are just, “I’m done.” ... The next year’s teachers looking at that data, they don’t know the kid did that ... When I saw that for my own eyes I said, “I can’t use the MAP test ever as a reliable gauge here.”

Teachers at Hawk also worry about administrative mishandling of data. UE expresses concern about NWEA MAP scores landing on the desk of a single secretary who, given free reign by administrators, draws cut scores for placement and doles out information to teachers as she sees fit. (Interestingly, UE describes the secretary as “on the ball” with her placement recommendations.) Other teachers do not discuss the practice, so UE may be misinformed. However, they do describe other examples of administrative missteps with data. Several wish that the school would administer the NWEA MAP assessment to all students, rather than just the ninth and tenth grades, as if a fuller implementation might foster more seriousness among students and yield more useful data. Teachers fear decision making in other programs, as well. Citing the school’s implementation of Advancement Via Individual Determination (AVID), a program that relies on data analysis to identify and challenge underachieving students to excel in rigorous courses, Hawk teachers feel that the deck is stacked against them with students who cannot perform. BT, an English teacher, relates a discovery that she and her colleagues made through informal discussions about students who were having trouble.

We found out with the boys that we were checking their transcripts, they’re AVID students. So because they’re AVID students, they’re put in the honors program. But ... they were barely passing my class. ... Oh, we get it now. We get how it works.

To these teachers, standardized testing data may be no more or less trustworthy than anything else that emerges from students. The teacher’s expertise in the content is required to

make sense of any of it, to use it properly. The teacher alone, then, is able to determine if test items yield accurate measurements or are off base. EU at Hawk describes one such question as complicated enough to almost trick students into an incorrect answer.

They answered the question as far as what was the value for X, but they needed to go back in and plug it in to find the value, find the measure of the angle. So there was an illustration with some angles and some expressions. And so they had to write an equation, solve the equation, take that value as the next step, and go back and find the value of each angle. And they stopped at X equals. It's a great standardized test question.

Here, the “great standardized test question” may have been a good gauge of student mastery, or it may just have been a good puzzle requiring persistence. The teacher possesses the content mastery to know which, and to understand exactly how to use data arising from that question.

For these teachers, some level of success and failure on standardized and other tests is inevitable, and largely uninformative. Their attention piques, however, when the needle moves a large number of degrees. If such movement aligns with their own measurements, they may see more usefulness to data from outside of the classroom. The results are useful, then, when they validate what teachers already feel they know about students. TX at Hawk describes alignment between early diagnostic writing in class and NWEA MAP assessment scores. EU, also at Hawk, notes that the MAP testing scores “usually fall right into place” with what he expects. This alignment allows EU to believe the “surprising ones where you're like, ‘Wow, that's a little higher than I expected.’” SX, the data guru at Raven, is the lone voice describing the use of outside data to diagnose the school's program. He notes “just knowing how those kids are doing is good measurement of how we're doing in those [college preparatory] and honors classes with those kids.”

Obstacles

My second research question concerns obstacles that teachers cite as influences over their use of data in decision making. The three most common obstacles that teachers cite are students, time, and underutilized tools. Students and time are the most common by far, with some variation in frequency between sites. With students, the primary concern among teachers is that attitudes do not allow for accurate measurements. Concerns about time align to the research literature; teachers say that they do not have time to engage in what they consider to be data-driven decision making, or feel that the time they do engage in such practices would be better spent on other projects. Underutilized tools are technology or testing that teachers believe are not developed enough, or with which they do not have enough training or time, to use toward data analysis. Table 7 summarizes obstacles that teachers mention across the three sites and both content areas.

Table 7

Obstacles: Frequencies of Codes and Numbers of Teachers

	Data Overload	Students	Absent Administrators	Size of Facility	Time	Underutilized Tools	Unhelpful People
All Teachers	4, 2	23, 10	5, 2	2, 2	21, 11	14, 7	1, 1
Teachers by Site							
Eagle	3, 1	9, 5	2, 1	2, 2	13, 6	7, 4	1, 1
Hawk	1, 1	11, 4	3, 1		6, 3	6, 2	
Raven		3, 1			2, 2	1, 1	
Teachers by Content Area							
English		15, 6	2, 1	1, 1	8, 5	5, 2	
Mathematics	4, 2	8, 4	3, 1	1, 1	13, 6	9, 4	1, 1

Note: Obstacles listed as “frequency of codes, number of teachers.”

Students. Hawk teachers cite students as an obstacle to data-driven decision making with the highest frequency, though not all of them cite this obstacle. Their concerns are threefold, but all revolve around distrust of student performance. First, they worry that students choose to disregard homework and other assignments, and choose to fail assessments. Second, they worry that students do not have the pre-requisite skills from earlier grades to yield valid pre-assessment data. Third, and unique to this school, is the concern that students present readiness to learn or other distracting issues that teachers attribute to socioeconomic factors in the community. TX, an English teacher, describes:

I learned that a lot of these kids come from backgrounds I don't understand, and if I don't understand it, I can't teach them from my world. They're not gonna get it. My world is completely different.

Teachers at Eagle share one of these concerns. They do not discuss socioeconomic issues in their wealthier community. Eagle teachers, who work in a regional high school district that enrolls students from multiple and separate K-8 districts, also do not express concern about performance in lower grades. Eagle teachers are worried about the validity of data that they collect from unmotivated, disinterested students. DM describes an online reading service that pre-assesses students prior to assigning leveled readings. The students fail on purpose, DM guesses, to get the easiest readings. "They're not stupid kids. They just don't apply themselves." Putting it even more bluntly, DM imagines that "it's, like, almost a different brand of kids we're getting in the past couple of years."

Teachers at Raven discuss the fewest obstacles overall. All of the discussion about students as obstacles at Raven comes from a single English teacher describing her regular testing and quizzing as grounded in distrust of student attention to reading assignments. "Lazy kids who buck the system also tend to be the brightest kids," she notes. "I run a tight ship."

Time. Time is the most prominent obstacle in the research literature. In these three schools, it competed with students as the chief obstacle reported by teachers, having fewer overall mentions but coming from one more teacher. Teachers do not have enough time to engage in data-driven decision making, particularly when the data come from above or elsewhere.

Discussions of time are more complicated than the simple conclusion that there is not enough of it. Some teachers admit that there is time before and after school, but that scheduling collaboration across conflicting schedules is the real problem. Others worry that data analysis will lead to additional goals, and thus additional work for which there is little time. Diagnostics and other common assessments, some say, are excellent starts. What comes next, however, may represent a snowballing project that will consume more time than anyone yet realizes. Data analysis and data-driven decision making, then, represent optimum practice in a perfect world. In these schools, however, teachers feel that they might go part of the way, but simply cannot go all of the way.

Teachers cite different reasons for a lack of time. These range from a chock-full curriculum that does not allow for adjustments in response to data analysis, to the amount of grading that has to be done, to the short duration of sessions in which data are analyzed, to the lack of common planning time with colleagues. In each case, teachers expect the answers to come from elsewhere. Only SX, the data guru at Raven, presented with initiative to take data on his own, analyze it, and bring conclusions to colleagues in the school, peers in the middle and elementary schools, and supervisors. The additional difficulty that teachers discuss is an unwillingness to use given time for data analysis. Several teachers prefer to use that time for lesson planning, or in other collaborative projects with colleagues.

Some teachers ultimately use the lack of time to justify a reactionary approach. They relegate data analysis to a strategy for students who are presenting concerns, rather than an approach to maximize achievement for all students. “With 80 students,” BT at Hawk says, “you can’t go through everybody. It’s kind of when the signals go up, like ‘Something is not right here.’”

Underutilized tools. Teachers in all three schools have access to assessment data through their student information or other computerized systems. Some of these systems simply warehouse data from standardized assessments like district-wide midterms or state assessments. Others are full assessment platforms, like the summer mathematics assignment system in Raven, the leveled reading solution at Eagle, or the NWEA MAP assessment at Hawk. Teachers feel that these systems have potential, but are underutilized. Either administrators and supervisors have made poor decisions about the implementation of these systems, or faults within the systems themselves limit their usefulness.

The NWEA MAP assessment draws a lot of criticism at Hawk. In addition to points discussed in prior sections, teachers complain about the complexity of the NWEA MAP assessment system. UE remembers training on the system. “I think they hung up the data of, like, one student. It took up half the wall. Or one class. So, imagine if you had 3 classes.” SG concurs, adding concerns about remembering his login for the system:

You can change your password to something that you’re familiar with, but your login name is your name and a bunch of digits that I’m never gonna remember. So, I never really get a chance to—unless ... they provide us it over and over again. You know?

Concerns about underutilized tools, when expressed in this way, seem similar to concerns about time. The process is asking teachers to do more than they are willing or able to do, given the structural parameters in which they work. According to some of the teachers, however, the

tools may be underutilized because they are unnecessary or misprescribed. Teachers' preference for their measurements as content area specialists is clear. In a perfect world, teachers seem to be saying, assessments and data warehousing tools would be very beneficial. Since this is not a perfect world, however, such tools are ultimately doomed and therefore likely a waste of time. These teachers preface their discussion of these tools with phrases like "in truth" and "if you want to know the real deal." They use the adverb "honestly." They have a sense of what they are being asked to do, and they are willing to play along to a certain extent. They do not, however, buy in.

Professional Literature

Professional literature presents a glimpse of that perfect world, that perfect school in which teachers work collaboratively to analyze data from common assessments toward the realization of school goals. This literature therefore has the potential to present a normative case. There is always time, and students are never obstacles. Tools are useful, accessible, and never confusing. There are no questions of usefulness. Protocols and shared ownership mitigate worries over control.

This study does not pretend to present a complete review of professional literature on the subject of data-driven decision making. That said, the pieces that participants recommend or which are prominent in the same publishers' catalogues do present differences that are worth noting, and which are relevant to this study. Table 8 summarizes notable features of the literature reviewed—the works' definitions of "data," and whether or not the role of data-driven decision making is as a process unto itself or in service to larger processes (such as PLC's or action research). I also include the year of publication to help place the literature in context, and order the works by that year.

Table 8

Professional Literature Reviewed

Publisher	Author(s)/ Editor(s)	Year	Title	Definition of Data	Data Analysis as a Practice
Solution Tree	DuFour, Dufour, Eaker, & Many	2006	<i>Learning by Doing: A Handbook for Professional Learning Communities at Work</i>	Data come primarily from assessments, though a “Data Worksheet” includes categories for academic data, “Engagement” data (attendance, participation in extracurriculars, etc.), discipline data, demographics, and satisfaction survey data.	Data analysis is a cornerstone of PLC work, a collaborative process for continuous improvement.
ASCD	Schmoker	2006	<i>Results Now: How We Can Achieve Unprecedented Improvements in Teaching and Learning</i>	Data come from common and standardized assessments, but a quarterly curriculum review includes analysis of team logs and student artifacts.	Data analysis is the answer to a lack of monitoring, but is one part of a larger reform model that includes realignment of curriculum, teacher evaluation, and more.
Corwin	Creighton	2007	<i>Schools and Data: The Educator’s Guide for Using Data to Improve Decision Making, 2nd Ed.</i>	Data come from standardized test scores, attendance records, and transcript data.	Data analysis is an important and mathematical practice on its own, and helps administrators and teachers understand student achievement.
Corwin	Love, ed.	2009	<i>Using Data to Improve Learning for All</i>	Data come from more than just test scores, arising from people and practices as well.	Data analysis is an important practice that requires its own structures and roles.
ASCD	James-Ward, Fisher, Frey, & Lapp	2013	<i>Using Data to Focus Instructional Improvement</i>	Data arise from many sources, and are hard (countable, from an official source) and soft (qualitative, coming through observation).	Data analysis is a cornerstone to working through a feedback loop in a process of action research.

Formality and usefulness in the perfect school. This selection of professional literature presents a school in which teachers share common language and common understanding of data analysis. The definitions of data and the processes imagined may be different from piece to

piece, but teachers are clear in their practice. There are no questions of usefulness. The perfect school has navigated issues of capacity and communication to ensure that teachers are prepared to engage in data-driven decision making with data that are believed by all to be relevant to classroom practice.

Specific structures and roles help to ensure common understanding. Love (2009) recommends data coaches, teachers who may spend their entire schedule in the role of ensuring that colleagues have the capacity to use data. This is not an informal role occupied by a particularly skilled and interested staff member like SX at Raven, but a job description in the organization. DuFour and colleagues (2006) also describe elaborate teaming structures and protocols to ensure common understanding and capacity.

Differences between content areas do not have a place in the professional literature. There is no discussion of any difference between English and mathematics teachers, and no suspicion that math teachers are more inclined than their “humanities brethren” to engage in data-driven decision making. In fact, many of these works take steps to demystify data analysis for readers who may not have a background in mathematics. Creighton (2007) includes screenshots and step-by-step instructions for using Microsoft Excel and SPSS throughout his work. He couples these with descriptions of the statistical concepts at work in those operations. Others (James-Ward, et al., 2013; Love, 2009; Dufour, et al, 2006) provide templates and forms for guiding educators through data analysis. Love (2009) even notes that, while there should be widespread data literacy among staff members, data coaches need only possess a basic knowledge of mathematics. Attitudes and habits of mind toward collaboration and continuous improvement are more important. DuFour and colleagues (2006) note that teachers and

administrators should not outsource data analysis to others. The Hawk secretary, who allegedly analyzes NWEA MAP assessment data, would have a very different role.

The mystique and intuition of the specialist has no place in the perfect school of professional literature. Schmoker (2006) is the most explicit in condemning the mindset of the specialist. Allowing teachers to work in isolation, he writes, has fostered an aura of mysterious artistry around their profession. This, he argues, works against any notion of measurability. The other authors do not condemn the mindset so specifically, or even mention it at all. Their conceptions of the perfect school—grounded in action research, continuous improvement, or professional learning communities—are nonetheless incompatible with the notion.

Obstacles in the perfect school. Not all of the pieces discuss obstacles. When they do, they prescribe specific remedies. Time is the most commonly mentioned obstacle. Only one of the pieces discusses students as obstacles, but its discussion does not validate any of the concerns raised by the teachers in this study. Technology tools are important to data analysis, but may present difficulties through their complexity.

In the perfect school, time is a significant but not insurmountable challenge. Schmoker (2006) believes that existing professional development is a waste of time that may be better spent on more sophisticated analysis. DuFour and colleagues (2006) and Love (2009) discuss specific remedies to a lack of time, such as common planning time and better utilization of existing meeting and prep/duty times. Love (2009) is so specific as to recommend 45 minutes of protected time each week. The largest response to the obstacle of time, however, seems to be in the larger processes of prioritization and goal setting that occur in continuous improvement and professional learning communities. The assumption is that teachers, if properly oriented to engage in these processes, will willingly give of their time. They will also know how to spend

their time to more and better effect. The professional literature seems to suggest that current complaints about time are be proxies for resistance or fear, or may signal an organizational lack of focus.

Only Love (2009) discusses students as obstacles. She recommends setting ground rules so that teachers do not blame students, or look toward any other external locus of control as an excuse for student performance. She recommends additional practices to serve as checks against cultural assumptions and bias that might interfere with analyses. The “Ladder of Inference,” for example, is a protocol that forces an examination of data to ensure that practitioners are not choosing data sources that align to predispositions. Another, the “Cultural Proficiency Continuum,” allows teachers and administrators to interrogate data analysis conclusions by classifying them on a scale between “cultural destructiveness” and “cultural proficiency.”

The perfect school requires technology for data analysis, but is concerned about obstacles that technology might present. Creighton (2007), by advancing tutorials of Microsoft Excel and SPSS, seems to admit that technology might be complicated. DuFour and colleagues (2006) also advocate technology for analysis, but warn that teachers “should not be expected to become either statisticians or data entry clerks” (p. 66). Here, then, we see two very different conceptions of technology use—one in which the manipulation of raw data in statistical models is important, and another in which technology should separate educators from that work and shorten the distance to actionable information. Despite these differences, neither piece (nor any of the others) imagines a scenario in which technology is misapplied, inconvenient to use, or otherwise irrelevant to teachers. The assumption is that technology is necessary to analysis, and never an obstacle in the hands of properly trained practitioners.

Summary

This study first asks how high school English and mathematics teachers describe their use of data. The findings relate directly to this question. Teacher participants have different conceptions of data-driven decision making. These conceptions are not only different between the sites, but also between their two content areas. The differences express themselves along a continuum that views practices as formal or informal, with data that teachers feel is useful or not useful to their teaching. Control rises as a key dimension. When teachers have more control over informal data in their classrooms, they tend to see data analysis as a useful practice. As formality increases, control decreases and teachers tend to see less value in data analysis.

The study further asks about the obstacles that teachers describe as influencing their decision making as they plan for and engage in data analysis. Teachers note three primary obstacles: time, students, and underutilized tools. Time is a prominent obstacle in both research and professional literature. In teachers' eyes, student motivation, readiness to learn, and other issues threaten the validity of data analysis. Underutilized tools, typically technology tools that are complicated or improperly implemented by administrators, also figure as obstacles.

A normative case provided by professional literature describes implementations of data-driven decision making in which teachers share understanding and language. Protocols and structures ensure that there are no questions about formality and usefulness. Obstacles, where they exist, are specifically mitigated through deliberate structures. Where students present as an obstacle, protocols guard against teacher preconceptions and bias. Time is available, either through structures like common planning periods, or through efforts to find better and clearer focus for professional development and goal setting.

CHAPTER V:

Discussion

Data-driven decision making has been at the root of school accountability and improvement initiatives for several decades. Various factors influence school implementation of data analysis projects, particularly teacher and leader sensemaking. This study explores the factors that affect secondary English and mathematics teacher definitions and sensemaking of data.

This final chapter connects the findings of the current case study to research literature, and advances a definition and typology of school data. I use my conceptual framework (Figure 1) to support this exploration. Following that, I discuss obstacles to data analysis that this study revealed. A brief discussion of implications then follows, and begins the conversation of how current practice may benefit from this study's findings. Finally, I discuss limitations of my methodology, and use them to inform recommendations for further research.

Defining "Data"

Definitions of "data" and "data-driven decision making" are easy to come by, but not easy to reconcile. I have shown that research literature presents at least two different conceptions of data. "Classic" definitions describe data as evidence of student achievement (Black & Wiliam, 1987). Systems theory, however, has broadened the definition to include any measure that contributes to a school's continuous improvement efforts (Crawford, et al., 2007; Ingram, et al.,

2004). The professional literature that I reviewed follows suit. When a work of professional literature describes data analysis as its own practice, devoid of any larger context of continuous improvement, data come primarily from measurements of the inputs and outputs of student achievement. When data analysis serves a larger structure such as professional learning communities, however, professional literature imagines a wider field of data that includes such measures as student and community satisfaction, discipline infractions, and more.

This study's conceptual framework offers a foundation for the study of teacher practice with and perceptions of data, aspects of data-driven decision making that are still quite thin in research literature. By considering effects of sensemaking, politics, organization, structures, and capacity, my framework recognizes the complexity of data use in schools. Goren (2012) reminds that all of these things matter. "Data do not, by themselves, lead to improvement" (Goren, 2012, p. 236). Given the complexity of issues swirling around school data use, we might suspect that a solid definition of "data" does not exist because it is elusive. A working definition of data, however, need not be overly complicated.

Data are information that educators collect, and/or that educators are expected to use, to guide their planning and their daily practice. This definition is broad, and does not attempt to qualify "data" in any way but to note organizational expectation for its use. Proceeding from this definition, this study of teacher perceptions reveals a spectrum of data, from which I can draw a typology (Table 9). Types fall into one of three categories. Classroom data occur in front a teacher, within those four walls. Shared data arise from combinations of data from multiple teachers' classrooms. Outside data are imposed upon a teacher's classroom.

Table 9

A Typology of Data in Schools

	Classroom Data		Shared Data		Outside Data	
	Opportunistic	Deliberate	Collegial	Collaborative	Local	Imposed
Coverage	Some	Most or All	Some	Most or All	Most or All	Most or All
Degree of Codification	Low	Low to Moderate	Low	Moderate	High	High
Degree of Teacher Control	High	Moderate	Moderate	Moderate	Low	Low
Degree of Perceived Usefulness	High	Moderate	Moderate	Low to Moderate	Low	Low
Considered "Data?"	No	Sometimes	No	Yes	Yes	Yes
Frequencies of Codes, Numbers of Teachers						
Eagle	19, 6	38, 6	6, 4	2, 2		5, 3
Hawk	16, 5	21, 5	2, 3	2, 2	17, 6	4, 3
Raven	11, 4	13, 6	2, 2	4, 2		3, 2
All	46, 15	72, 17	10, 9	8, 6	17, 6	12, 8

This typology expresses itself across several dimensions. The dimension of coverage describes the number of students within a teacher's classroom that a particular type of data is likely to describe. It ranges from "some" to "all." The degree of codification describes the formality of data, more specifically the degree to which data are aggregated, scaled, normed, clustered, and/or symbolically represented beyond raw numbers easily related to specific assessment items or other discrete measurements. It ranges from "low" to "high." The degree of teacher control describes the amount of control a teacher has over the measurement and codification of data, and ranges from "low" to "high." This study finds different levels of perceived usefulness for each type, which ranges from "low" to "high." Finally, teachers in this

study describe some types as rising to the level of their own definitions of “data” (“yes” or “sometimes”), or may consider the measurement falling short of those definitions (“no”).

Dimensions show potential relationships to one another. In Chapter IV, I find that high levels of teacher control are related both to low levels of codification and high levels of perceived usefulness. The higher the level of codification, and the less control teachers have, the less useful teachers consider the data to be. There is also a relationship between these dimensions and whether or not teachers consider the data type to be “data.” Teachers perceive high levels of codification and low levels of control to be qualities of true data. A teacher polling students, and going as far as recording and tabulating hands raised from every student, does not feel confident that he is working with data. A teacher who works in her classroom with a piece of technology that basically does the same thing, however, does consider the information to rise to the level of “data.” The technology is the only difference between these two scenarios. That technology increases the level of codification by removing the teacher one or more steps from the raw data, and therefore also reduces the level of teacher control over the data.

The following sections describe the six types of data and their expressions across the typology’s dimensions. Each section also discusses relevant findings from Chapter IV. This study’s conceptual framework provides context for these discussions.

Classroom data. Teachers have the most control over data that they collect themselves. Teachers determine which students to include in the measurement, how to record it, and how to aggregate and codify it. Teachers do not typically share classroom data with other teachers, except in collegial and unstructured conversations. In this study, classroom data appears in two types: *opportunistic*, in which teachers rely upon their own expertise to draw conclusions from

limited data collection, and *deliberate*, in which technology or other structures bring wider coverage and more formal codification to data collection and analysis.

Opportunistic. This least formal type of data represents the best example of the effects of sensemaking on teacher conceptions of data and data-driven decision making. Teachers enact practices that they believe to be effective, relying on their own expertise and conceptions to decide when, how, and with how many students to gather and analyze information. Examples in this study include student body language and student answers during whole-class discussions. Teachers do not consider information of this type as rising to the level of “data,” even when they use this information to adjust planning or practice. They nonetheless consider opportunistic data to be the most useful data that they have.

Teachers in this study are distrustful of outside data unless it validates what they have already seen in opportunistic data. In this way, usefulness of classroom data seems related to their conceptions of themselves as content area specialists who are able to use opportunistic data effectively. An English teacher possesses expertise that allows for insights into the construction of knowledge through reading and writing that a mathematics teacher would not possess. Likewise, a math teacher is able to predict where students may run into trouble on a mathematics exam without any preassessment, based on the nature and complexity of the content. In this study, I encountered teachers in all three schools and in both content areas who feel that they know how their students will fare by the end of the year, and even in college, based on student questions and body language in discussions, or student performance on the first few graded assignments. When teachers compare outside data to these conclusions, they are validating those outside data against their own expertise rather than validating their opportunistic measurements.

In this type, teachers work with data describing social as well as cognitive phenomena within their classrooms. As data become more formal throughout the rest of the typology, they focus on evidence of achievement rather than measures of engagement, cooperation, and satisfaction. The practices of “Knowing the Students” and “Engaging the Students” signal this kind of analysis. In the former, teachers attempt to create relevance for students—e.g., knowing a favorite sports team to use as an example within a problem or class discussion—or to understand personal or other challenges that students might bring to the classroom. In the latter, teachers look for signals of student connection with classwork, and may be satisfied if engagement is high without actually measuring cognition. If I combine these two practices into the single practice of “Analyzing Social Data,” it becomes the highest frequency practice in this most informal type. It does not serve the same ends as data on student achievement, but rather helps to ensure a smoother lesson and a more compliant class.

Deliberate. Classroom data has more codification and coverage when teachers introduce technology and/or protocols. Examples in this study include online quizzing platforms, remote responders, exit tickets, whole-class polling, and worksheets for student reflection at the end of each week. Deliberate classroom data cover more students and present with more codification, but teachers are still unsure of whether these data are worthy of the label. In this study, technology solutions like online quizzing platforms and remote responders yield “data,” but teachers are surprised at the notion that polling through raised hands, paper exit tickets and reflection worksheets, and other non-technological approaches yield “data.”

Deliberate data proceed with less teacher control than opportunistic data. Broader coverage lessens a teacher’s ability to determine subjects, as they do with scans of body language and other opportunistic “spot checks.” Technology solutions introduce aggregation and

codification that, while convenient for the teacher, also threaten control. In Eagle, for example, supervisors and principals have access to each teacher's data in the school's online reading intervention. Alongside this loss of control through broader coverage and increased codification, teachers express more concerns about usefulness. Returning to the example of Eagle's online reading intervention, teachers worry that students do not universally take the program seriously, and thus potentially skew the data.

Shared data. When teachers come together to discuss classroom data, or participate in assessment or other curricular projects that yield similarly organized and codified data across multiple classrooms, their perceptions depend upon the specific nature of the discussions and projects. When teachers come together with *collegial* data, they may control at least half of the information in the conversation but might not have any protocols for elevating that data beyond an opportunistic type. Supervisors and administrators may also construct large calendared projects such as common assessments and department or district midterm examinations. These yield *collaborative* data that are similar to the deliberate type, but which exist across multiple classrooms. In general, teachers in this study appreciated the time with colleagues to discuss shared data, but were free to use or discard them.

Collegial. Judith Warren Little (1990) notes that "collegiality" carries an "automatic sense of virtue" (p. 509), a belief that teachers sharing their expertise will inevitably improve one another's practice. She describes storytelling and scanning for ideas as the least interdependent forms of collaboration (Little, 1990). In this study, teachers describe such voluntary storytelling and scanning, and use collegial data in those interactions to validate what they might already believe about their students. Teachers in all three schools may approach colleagues for ideas on how to teach a particularly tough unit, or for insight into a student whom they both share and

who might be experiencing difficulty. In these conversations, collegial data may come from a pooling of their own opportunistic and deliberate classroom data. In Hawk, one teacher describes entering into such conversations with common rubrics, but not necessarily common assessments.

Ascribing degrees of usefulness and control to collegial data is difficult without a deeper understanding of the goals with which teachers enter into these conversations. If it is reactionary—to seek validation of what teachers have observed through classroom data—then control and usefulness are high, though not necessarily toward change in planning and practice. Teachers are unsure of whether or not such conversations turn on “data.” (By my definition, so am I.) Where teachers compare deliberate classroom data in more structured projects—as when two Eagle teachers use data from their online reading intervention, or two Hawk teachers pool classroom data to determine if AVID students are in the most appropriate class level—they are giving up some control, and perceived usefulness varies. In Eagle, a teacher describes the important role that her supervisor played in cheerleading and validating a collaborative data analysis project. In Hawk, however, a teacher does not describe supervisory support (or even presence) in a similar collaborative data analysis project. While the Eagle project spurred the two participating teachers to revisit some subjects in their classrooms, the Hawk teachers left their project feeling that they had validated a suspicion about improper placements of AVID students for the benefit of that program. Their findings did not, as far as I can determine, influence their planning and practice.

Teachers share social data about specific students that they have in common, but are concerned about knowing too much about students’ cognition beforehand. Frequencies for using data to know the students are as high as, if not higher than common assessment in this type. Diagnostic/prescriptive practice focusing on cognitive strengths and deficiencies, however, is

entirely absent. Teachers are at once concerned about having preconceptions about academic skills and knowing what challenges and preferences might interfere with their efforts to connect socially with students. Several teachers voice a desire to start the year with a blank slate, as if each teacher's approach were so different that knowing a prior teacher's assessment of a student's cognitive strengths and weaknesses would create bias for or against the student. Some teachers would rather have information that contributes to engagement, explains behavior, or otherwise informs efforts to ensure smooth day-to-day operations. As in the opportunistic type of classroom data, social and cognitive data remain separate and serve different purposes rather than come together toward a fuller understanding of student achievement.

Collaborative. When teachers work in teams on more directed and structured projects to pool classroom data, codification increases as teacher control potentially decreases. Common assessments are the most prominent example in this study. In each school, however, teachers describe more formality around the process of creating the assessments than in administering them or analyzing results. At Hawk, for example, math teachers are free to edit or even ignore a common assessment if they taught the procedures differently, or did not yet reach a particular point in the curriculum. Teachers value time with colleagues in the creation of these assessments, but they do always not see (and are apparently not always obligated to find) alignment to their own practice. While they recognize the results as “data,” their analysis can be quite casual.

That said, supervisors and other individuals play key roles in two of the schools to increase usefulness of collaborative data for teachers. In Eagle and Raven, supervisors are actively engaged in structuring assessment development and data analysis to ensure that conclusions have some impact, even if that impact is with teachers of lower grades. SX at Raven, the former financial executive who now teaches mathematics, is important to colleagues and

supervisors alike not only for aggregating common assessment data, but also for correlating it through sophisticated analyses to data from external assessments, both to pinpoint student weaknesses and to diagnose the validity of locally-developed tests.

Outside data. Data that come from beyond the classroom door fall into two types. *Local* data come both from external assessments that the school purchases and administers (such as the NWEA MAP assessment at Hawk), and from measurements of phenomena that originate in the school but do not impact directly on any one classroom (such as attendance and discipline). *External* data come primarily from standardized tests over which the school has very little control. These include college entrance assessments like the SAT and ACT, but also state graduation examinations like the New Jersey HSPA. In both types, the level of codification is very high. Teachers may only see cluster or other aggregate data, and cannot tie any particular piece of data back to any specific question. The degree of teacher control is very low. In this study, teachers feel that both types are of little usefulness to their daily practice, but that both types certainly represent “data.”

Local. The three sites in this study did not present a common approach to data of this type, with teachers from only Hawk and Eagle providing examples. At Hawk, teachers see the NWEA MAP assessment as a troublesome project that is only useful when it validates what they have already observed through classroom data. At Eagle, some teachers participate enthusiastically in interdisciplinary committees working with school-wide attendance and other data, but see no alignment to their own classroom practice.

Hawk’s implementation of the NWEA MAP assessment, while exemplifying this data type, also provides insights into fear and distrust of data that are entirely out of teachers’ control. Hawk teachers describe ineffective communication about the goals and value of the NWEA

MAP assessment. They do not trust that the data are leading to valid decisions about placement. They do not believe that the school's implementation of the exam is in the best interest of student learning in their content areas, or even that it operates through a valid testing environment. They are nonetheless pleased when MAP assessment results agree with their own measurements.

Eagle is the only school in which teachers work on interdisciplinary committees to analyze school-wide data. While teachers describe these activities as valuable to collegiality in the school, they do not see connections between these analyses and their own practice. Often, teachers in such committees at Eagle are examining attendance other data in a school-wide scope. It is easy for them to separate their own practice from such high-level data. These committees recommend interventions at the school level to affect school-wide goals—e.g., incentive programs for good attendance. By making recommendations at such levels, these committees maintain the separation between data analysis and classroom practice. They fail to create teacher accountability for interventions, which can succeed or fail safely, with either common celebration or a total lack of any specific responsibility the only possible implications.

Imposed. Scores from external assessments represent the most public forms of school data in New Jersey. High school averages on the HSPA, along with averages on AP and SAT tests, are all prominent measurements in state performance reports, “best school” lists in the media, and realtor recommendations to prospective buyers in suburban municipalities. Still, teachers in this study express the least usefulness in (and the most fear of) this data type. This combines with the lowest degree of control and the highest degree of codification.

Organizational and political expectations color teacher willingness to work with external data. At worst, teachers in this study fear that leaders will use these data in merit pay and other employment schemes. This fear is most pronounced in Hawk, the lowest DFG school of the three

and the school in which teachers describe readiness-to-learn issues that leave them feeling helpless and inadequate. In Raven and Eagle, both in wealthier communities, teachers worry less about readiness-to-learn issues and more about inadequate preparation by prior years' teachers or disinterested, unmotivated students. They count on supervisors and administrators to communicate those concerns to lower grade teachers, and do not discuss any efforts to work collaboratively with those teachers to rectify issues. Professional literature describes tools ranging from simple tutorials to complex protocols for controlling fear and bias, and turning these data into actionable information. Teachers at these three schools do not describe the presence of any such tools.

The teachers in this study do not believe that external data are relevant to their practice, even though such data are important to public (and political) evaluations of the school. In fact, some teachers are doubtful that these tests measure student learning at all. Instead, these assessments may be full of puzzles and trick questions that, while grounded in content knowledge, do not accurately describe what students know. One Hawk teacher describes testmakers as “out to get” students, implying that there are political, socioeconomic, or other interests behind standardized testing that hope to undermine public schooling (or at least the schooling of underprivileged students).

Obstacles to Data Use

The preceding discussion suggests that teacher perceptions of data usefulness, in the face of both increasing codification and decreasing teacher control, work through teacher sensemaking to present obstacles to data use across the entire typology. These three schools also display a lack of capacity, which is prominent as an obstacle in the research literature. Teachers

in these schools also cite specific structural obstacles: time and underutilized tools. They also discuss students as an obstacle to data analysis.

Capacity. Lack of capacity is one of the chief obstacles to data analysis (Brunner, et al., 2005; Kerr, et al., 2006; Supovitz & Klein, 2003). When teachers attempt to engage in data analysis, they may concentrate on “big picture” data in the form of large-scale averages rather than dive into more informative cluster scores, and they may adopt interventions that “teach to the test” rather than effect meaningful alignment between curriculum and accountability (Monfils, et al., 2004). This may be more likely as data become more formal. The volume and level of codification of data from external standardized assessments may be too much to be useful to teachers (Luo, 2008; Mandinach, et al., 2006).

Teachers in all three schools express confusion, either at the complicated expression or overwhelming flood of data. In the face of this confusion, one teacher at Eagle is satisfied to take merely one or two simple conclusions—whatever may jump out at him—from volumes of state assessment data rather than engage in sophisticated analysis that moves methodically to create actionable information from data. Several teachers at Hawk describe the confusing presentation of large amounts of data flowing from the NWEA MAP assessment. Even the usernames and passwords are confusing and impossible to remember. Teachers at Raven depend on SX to pick apart complicated data. He leverages skills from a prior career, skills that teachers feel they cannot or do not need to master.

Individuals can make a difference. SX at Raven uses his access to various computer systems to gather, aggregate, and simplify data for colleagues and administrators. In some ways, however, his work is more important to administrators than to his colleagues. Administrators and supervisors often turn his conclusions back to teachers or to the community. SX engages in many

sophisticated data analysis projects in his own classroom. He is an exception among all of this study's participants; he describes, for example, aggregating data from several external and local assessments into a single analysis of student weaknesses in his classroom, and adjusting his practice to address those weaknesses. He describes his methods as foreign to the teaching profession, though of obvious value to the improvement of student achievement. His analyses have wide ripples in Raven, the smallest of the three schools. The district central office is located in the high school in which he teaches. He is the only teacher of certain Advanced Placement courses in the district. He is well placed in this small community to have an impact. In Hawk or Eagle, he might need to be in several places at once, or have no teaching duties at all, to have a similar impact.

In all three schools, participants either celebrate the presence or complain about the absence of supervisors. Supervisors are described as most valuable when they simplify data, carry conclusions to corners that teachers cannot reach (such as teachers of younger grades), and encourage teachers to engage in data analysis that teachers themselves propose. In the lattermost case, teachers seem most appreciative when a supervisor agrees with teachers on the value of particular data, or the potential efficacy of a particular response. At Eagle, for example, English teachers describe the cheerleading of their supervisor as instrumental in the success of collaborative projects in which they diagnosed student deficiencies and implemented interventions.

Time. When asked about obstacles to data-driven decision making, teachers in this study are quick to toss “time” onto the table—a single word, with little discussion, as if it is almost too obvious to mention but which that they bring up only to ensure that my record is complete. Time has both objective and subjective qualities. There is, indeed, little time for teachers to spend.

However, teachers admit to making choices about how to spend the time that they have. If they have to work together through an agenda that someone else is forcing upon them, there are things they would be more willing to do than others. Analyzing external data seems to be near the bottom of the list for teachers in these three schools.

Time, then, is a nuanced challenge for educational leaders. Teachers do not simply have a lack of time. Rather, teachers may have a selective lack of time. They have time for—or willingness to spend time on—some activities, but not others. Teachers in this study reject structured analysis of formal data as a waste of time, but sometimes agree that they would have time to participate in other formal activities that supervisors structure for them—collaborative development of common assessments, and collaborative lesson and unit development, for example.

However, teachers in this study do not typically engage in these other activities out of their own initiative. Teacher preference to be led into collaborative and reflective activities, and their unwillingness to initiate them, may validate Lortie's (1975) notion of an isolating profession that pushes teachers to develop their own and highly private metrics for success, nearly forty years on from the original publication of his landmark study. It might also show the lack of coordinating structures in these schools to lead teachers beyond the safe and collegial collaboration that Little (1990) describes, and into the more intense realms of truly "joint work."

Students. Teachers cite students as an obstacle in all three schools. In Eagle and Raven, student motivation affects the usefulness of data. At Eagle, teachers worry that student dishonesty on preassessments undermines the validity of deliberate classroom data. When students fail pretests on purpose, teachers view the whole operation as suspect. Teachers at Hawk consider expectations for student achievement and growth to be unrealistic to a degree that

Raven and Eagle teachers do not express. Student boredom might be a challenge that teachers at Raven and Eagle consider themselves capable of addressing, if there were willingness or more time. Teachers at Hawk, however, worry that the readiness-to-learn issues are insurmountable.

Interestingly, English teachers cite students as an obstacle more often than mathematics teachers. English teachers in this study are more interested in knowing student hobbies and interests. If students are not forthcoming, then those teachers might be more inclined to view students as an obstacle to their data collection and analysis. Math teachers in this study, on the other hand, are less interested in student interests and hobbies, and less inclined to consider students an obstacle to their use of data.

Only one piece of professional literature in this study suggests that teachers might view students as an obstacle. Love (2009) describes tools and protocols to help teachers overcome bias that would lead them to consider students as obstacles. Such tools may be useful in helping Hawk teachers approach the readiness-to-learn issues that trouble them, but do not seem appropriate for addressing the motivation issues that Eagle and Raven teachers raise.

At the time of my interviews, teachers had not yet faced state mandates to advance student growth objectives—goals tied to student advancement through pre- and post-assessments, tied to teachers' evaluation. None of these three schools are among the pilot schools that participated in evaluation systems prior to required statewide implementation in September, 2013. Accountability systems tied to student achievement seem to assume that such data are automatically trustworthy. Teachers in all three schools in this study, however, describe students as participants and even adversaries in data-driven decision making in ways that literature (and perhaps also policy) has not yet considered.

Underutilized tools. Teacher discussions of underutilized tools in this study stem from their frustration at not being consulted (or not participating) in discussions about implementation. This is clearest at Hawk, where teachers present a list of problems with the school's implementation of the NWEA MAP assessment. They feel that the assessment should be given to all students rather than select grades, that the testing environment should be more secure, and that teachers and administrators should have more knowledge of and determination over placement cut scores that arise from the assessment.

Teachers at Raven and Eagle also discuss underutilized tools, but lay more of the responsibility at their own feet. They do not use the tools as often as they should. At Eagle, teachers speak of a student achievement tracking system that they might consult more often, but which they only consult for data on midterm examinations. At Raven, teachers suspect that student achievement data might be warehoused in their student information system, but are not entirely sure. In some cases, they know that data guru SX works with such data, and probably imports it into the system. If they have need, teachers say, they can probably find the data or get it from him. They typically do not have need, as supervisors present all of the data required for data analysis projects.

Technology occupies an interesting place in the discussion of underutilized tools. Teachers appreciate technology that formalizes classroom data without threatening teacher control. Some mathematics teachers at Raven appreciate the district's summer assignment platform. Teachers at Eagle appreciate reading and writing solutions, as well as digital white boards equipped with remote responders. In all three schools, however, teachers view systems that warehouse more formal data from common or external assessments as underutilized or improperly implemented.

This study confirms that a lack of capacity is an obstacle to data-driven decision making. The teachers in this study also struggle with time, but I note that time has both objective and subjective qualities. The teachers in this study list students and underutilized tools as obstacles. These obstacles are not absolute and irrefutable. They seem to arise, in part, from sensemaking and decision making—both on the part of teachers as they approach data across the typology, and on the part of leaders as they build structures for and facilitate those activities.

Implications for Practice

As of this writing, New Jersey teachers are implementing a new evaluation system that ties student achievement to teacher evaluation. Currently, 15% of a secondary teacher's evaluation score derives from student achievement of teacher goals that require pre- and post-assessment and periodic benchmarking. The structure of this requirement forces alignment between teacher practice and external accountability through data analysis. The findings of this study shed some light on levers that school leaders may wish to pull for better teacher responses.

Recognize gulfs between policy and practice. When policy makers connect student achievement on assessments to expectations for teacher data analysis, narrow and “traditional” definitions of data supersede broader systems theory definitions. Schools committed to continuous improvement through such structures as professional learning communities, however, sometimes expect teachers to value data for which policy does not hold them accountable. Consider the committee of teachers at Eagle analyzing school-wide attendance trends. We should not be surprised when those teachers, subject to policy that focuses on the achievement of their students, fail to internalize attendance data into their daily practice. The teachers see no connection. In fact, despite working on an interdisciplinary data analysis team, mathematics and English teachers still harbor misconceptions about how the others work with data. Their work

with those organizational data seems to have nothing to teach them about data analysis in their classrooms.

Teachers in this study do not side with policy makers, either. Teacher conceptions of outside data on student achievement are clear. Teachers do not consider these data to be meaningful or useful. Instead, they value the much more informal data that they collect on their own, often without full coverage or standardization. Frequencies of practices show that teachers are engaged in such informal data collection and analysis much more often than in collaborative and more formal data-driven decision making. My typology suggests several possible reasons for this. Codification abstracts data to a point at which teachers cannot understand specific strengths and deficiencies of individual students. Cluster scores, disaggregated means, and the like are perhaps a bit too removed from the day-to-day, or schools have not built sufficient capacity for teachers to leverage those data with any impact. However, issues of control and a sense of specialization among teachers may also be contributing, and may be harder to mitigate.

Several gulfs in understanding thus separate the players, befuddling alignment throughout the entire system. Teachers in this study collect a lot of information. Often, they collect that information opportunistically and even informally, relying on their expertise to fill in any blanks. They do not believe that administrators would consider this information to be “data.”

Administrators in these schools profess commitment to continuous improvement, but may push teachers toward analyses of “benign” organizational data. When achievement data come to the table, supervisors and administrators may already have analyzed them for teachers.

Administrators are therefore unclear about what “data” are, and where teacher responsibilities for analysis begin and end. Policy makers, however, connect teacher practice to data with an ever-sharpening focus on student achievement. Policy makers assume that teachers will analyze those

data to ensure success for every student, and that administrators will support and build capacity for such analyses.

Promote common understanding. Policy makers therefore rely upon accountability to create alignment between teacher practice and statewide (even national) goals. Compliance responses on the part of schools and teachers, however, do not guarantee authentic alignment. Such responses are nonetheless understandable. Classrooms are isolating, leaving teachers to develop their own metrics for success (Lortie, 1975). In this view, it makes sense that teachers would prefer data over which they have complete control, and that teachers would rely upon expertise and experience to assign currency to those data. This study's findings do not discount the possibility that school leaders can forge common understanding and definitions that, if applied through deliberate protocols, may bring more alignment among teacher, school, and policy-maker goals through data analysis. Professional learning communities are a prominent example of such protocols in professional literature.

In implementing such protocols, school leaders should take time to forge common definitions. Common definitions, one would hope, would ensure that all teachers understand the reasons for and value of any tools and roles advanced. Teachers in this study fail to see the reasons and value, naming underutilized tools as an obstacle to data-driven decision making, and showing reliance upon supervisors and other individuals to do data analysis for them.

If capacity is an issue, roles and structures can help to ensure that teachers are able to use appropriate technologies and protocols to draw conclusions from all types of data. A teacher like SX at Raven, for example, might make an effective data coach. If collaboration is an issue, then staff members might be trained to facilitate professional learning communities connecting teacher practice to school-wide data.

Explore the efficacy of common assessments. If teacher evaluation and other policies leave us with a white hot iron, collaborative data may represent the best place to strike. In my typology, collaborative data expresses across dimensions of control and usefulness in a way that suggests that teachers are willing to participate, and assign some value to the data. Common assessments may represent a middle ground between teachers' work with classroom data over which they exert complete control, and their work with data from external assessments over which the school exerts little or no control.

When this study's teachers do engage in common assessment, however, they prioritize assessment development over data analysis. In one school, they are free to ignore the assessments altogether. Leaders may need to incentivize ownership and participation with the message that teachers are accountable to the common understandings that they all own and to which they all contribute. Distributed leadership in these efforts may allow teachers to take meaningful roles in enforcing those understandings and forge healthier systems of internal accountability.

Study Limitations

This study offers new views over teacher conceptions of data-driven decision making. Teacher descriptions of their work with data show that there may still be wide misalignments between accountability and classroom practice. This study of teachers' descriptions of their practice has allowed for a definition and typology of data in schools. The methodology uncovering these descriptions, however, limits generalizability.

This study's participant pool is small, including just eighteen teachers across three schools. Supervisors and administrators did not participate in all three schools. The sample size allowed for manageable data handling, and provided important insights into individual

conceptions of data-driven decision making. While the sample was spread across multiple sites of different sizes and socioeconomic statuses, the generalizability of findings crumbled as I drilled into any particular criterion. Considering just math or English teachers, for example, reduced my sample size from eighteen to nine teachers. Likewise, it would be impossible for me to assert any generalizability to schools that are demographically similar to any of the three sites in this study. Three mathematics and three English teachers in each school is too small a sample even to generalize to each school's larger department, even in the smallest school.

My methodology relied upon one-time interviews. I believe that this increased participation. Even though my protocol attempted to account for as many dimensions of the study's conceptual framework as possible, I was not able to probe more deeply into emergent themes or seek deeper clarification. The dialogue between participants was limited to what my coding could uncover. This was particularly pronounced at Raven, where I had limited time with each participant. This is reflected in the frequencies of codes in that site, which are lower than in the other two sites.

Teacher reports of their practices and perceptions, while important to this study's research questions, represent a limitation. I am not able to verify that those reports accurately describe actual practice in each school's classrooms. Limited access to supervisors and administrators stunted my ability to confirm teacher reports. Lacking data from observations and other corroborating sources, I must qualify my findings as the reported perceptions of teacher participants, only. Multiple participants in each of three schools and reviews of professional literature recommended by participants serve as my only triangulating data.

These limitations affect the generalizability of my findings, but do not discount them. My research questions focus on teacher perceptions in secondary schools. The study's framework

positions individual teacher sensemaking as a key factor affecting data-driven decision making. The design, even with its limitations, allows for a window into those perceptions and that sensemaking.

Recommendations for Further Research

Achievement of policy makers' goals depends largely upon the efforts of millions of individual teachers working directly with students. Researchers have studied policy implementation in classrooms, but have not shed much light on how teachers perceive of and practice data-driven decision making, a cornerstone of educational reform for decades. Indeed, politicians, researchers, authors of professional literature, and even school leaders have all assumed that there is common understanding of key terms such as "data." This study shows that teachers have individual understandings of and responses to data, at least as far as my sampling methodology allows. Additional research can add detail, as well as confirm or refute the definition and typology of data that I present.

The first suggestion is to confirm participant reports with additional data. Observations, surveys, and other methods might solidify my findings in these particular or similar sites. In addition, perceptions of students and parents, as well as additional insights from administrators and supervisors, would provide more context around the local accountability in which teachers operate. Administrators and supervisors would also allow for deeper insights into goals and intentions behind school decisions, which could serve to confirm teacher impressions of those decisions. The administrative story behind Hawk's NWEA MAP assessment, for example, would be important to gaining a full understanding of that controversial implementation. Expansion of the pool to the rest of teachers within participants' departments and in other departments would also help to show whether participant reports align to school-wide perceptions. Since

administrators and supervisors selected participants based upon perceived uncommon expertise, there is a possibility that participants are outliers.

The second suggestion is to develop richer understanding of data-driven decision making in a single site. An instrumental case study in one school would serve to check and deepen my findings (Creswell, 2007). More sustained contact with participants, with more opportunities for observation through all phases of data-driven decision making projects, would allow researchers to study the evolution of perceptions over time. It would also allow for more attention to administrative directions, a fuller accounting of obstacles such as time, and observations of the actions of teachers occupying different roles (such as data coach, facilitator, or self-appointed data guru).

Broad quantitative study would, at the same time, test this study's findings and themes against a much larger pool of participants. Surveying teachers across the state would help researchers determine if the sites in this study are representative of their socioeconomic groups or sizes. Surveys could also determine if there are threads of common understanding among teachers, and whether teachers across the state perceive data-driven decision making primarily through compliance or organizational learning lenses. Indeed, gathering data on how teachers define such key terms as "data," "data analysis," and "data-driven decision making" would provide interesting comparison to the definitions of policy makers, and to the definition and typology that I advance.

Finally, deeper study of schools that have already enacted this study's recommendations, particularly the institutionalization of protocols, structures and roles to forge common understanding of data-driven decision making, would be valuable. This would not only serve to validate this study's findings and recommendations, but may also lead to the development of

criteria for identifying schools that are expert versus emerging in their shift toward organizational learning responses to accountability through data-driven decision making. Currently, no such criteria exist. Instrumental case or other studies in such schools may provide much-needed examples of “what’s possible,” with advice for specific practices and structures that can guide schools toward more effective implementations of data-driven decision making.

Summary

“Data-driven decision making” has been a prescription for school and teacher accountability for decades. As new testing and teacher evaluation initiatives evolve, expectations for analysis of student achievement data are moving from central and school offices to the classroom. This study raises questions about the success of policy-makers’ efforts to ensure that schools and teachers have a solid foundation through common understanding to engage in data-driven decision making aligned to state and national goals. In three schools professing a commitment to data-driven decision making, teachers identified as expert analysts value expertise and experience over data, work in isolation more often than collaboration as they make sense of student achievement, and have little trust or faith in data that they do not directly control. Their perceptions have led to a typology of data in schools that may identify common assessment as a practice worth exploring for school leaders hoping to create more alignment between internal and external sources of accountability. Further study can serve to confirm both the typology and my discussion of its implications, as well as provide more information on how teachers perceive and work with data.

REFERENCES

ASCD. About ASCD. Retrieved October 3, 2013, from <http://www.ascd.org/about-ascd.aspx>

Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education*, 5 (1), 7-74.

Breiter, A., & Light, D. (2006). Data for school improvement: Factors for designing effective information systems to support decision-making in schools. *Educational Technology & Society*, 9 (3), 206-217.

Brunner, C., Fasca, C., Heinze, J., Honey, M., Light, D., & Mandinach, E. (2005). Linking data and learning: The Grow Network study. *Journal of Education for Students Placed at Risk*, 10 (3), 241-267.

Coburn, C. E. (2005). The role of nonsystem actors in the relationship between policy and practice: The case of reading instruction in California. *Educational Evaluation and Policy Analysis*, 27 (1), 23-52.

Coburn, C. E., & Turner, E. O. (2012). The practice of data use: An introduction. *American Journal of Education*, 118 (2), 99-111.

Coburn, C. E., Toure, J., & Yamashita, M. (2009). Evidence, interpretation, and persuasion: Instructional decision making in the district central office. *Teachers College Record* 111 (4), 1115-1161.

Coffey, A., & Atkinson, P. (1996). *Making sense of qualitative data: complementary research strategies*. Thousand Oaks, CA: SAGE.

- Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. B. Resnick (Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 453-494). Hillsdale, NJ: Erlbaum.
- Corwin. Corwin ... Your partner in professional education. Retrieved October 1, 2013, from <http://www.corwin.com/about/company.html>
- Crawford, V. M., Schlager, M. S., Pennuel, W. R., & Toyama, Y. (2007). Supporting the art of teaching in a data-rich, high-performance learning environment. In E. B. Mandinach and M. Honey (Eds.), *Linking data and learning*. New York: Teachers College Press.
- Creighton, T. (2007). *Schools and data; The educator's guide for using data to improve instruction*. Thousand Oaks, CA: Corwin.
- Creswell, J. W. (2007). *Qualitative inquiry & research design: Choosing among five approaches*. Thousand Oaks, CA: SAGE Publications.
- Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into Practice*, 39 (3), 124-130.
- Danielson Group. The framework for teaching. Retrieved February 3, 2014, from <http://www.danielsongroup.org/article.aspx?page=frameworkforteaching>
- Dembosky, J. W., Pane, J. F., Barney, H., & Christina, R. (2005, December). *Data driven decisionmaking in Southwestern Pennsylvania school districts* (RAND Education Working Paper, WR-326-HE/GF). Santa Monica, CA: RAND Education.
- DuFour, R., & Eaker, R. (1998). *Professional learning communities at work: Best practices for enhancing student achievement*. Bloomington, IN: Solution Tree Press.
- DuFour, R., DuFour, R., Eaker, R., & Many, T. (2006). *Learning by doing: Professional learning communities at work*. Bloomington, IN: Solution Tree Press.

- Earl, L. (2008). "Leadership for evidence-informed conversations." In L. Earl and H. Timperley, *Professional learning conversations: Challenges in using evidence for improvement*. New York: Springer.
- Earl, L., & Fullan, M. (2003). Using data in leadership for learning. *Cambridge Journal of Education*, 33 (3), 383-394.
- Elmore, R. F. (2000). *Building a new structure for school leadership*. Washington, D.C.: Albert Shanker Institute.
- Elmore, R. F., & Burney, D. (1999) Investing in teacher learning: Staff development and instructional improvement. In L. Darling-Hammond & G. Sykes (Eds.), *Teaching as the Learning Profession: Handbook of Policy and Practice* (pp. 263-291).
- Even, R., & Kvatinsky, T. (2010). What mathematics do teachers with contrasting teaching approaches address in probability lessons? *Educational Studies in Mathematics*, 74 (3), 207-222.
- Feldman, J., & Tung, R. (2001). Using data-based inquiry and decision making to improve instruction. *ERS Spectrum*, 19 (3), 10-19.
- Firestone, W. A. (1987). Meaning in method: The rhetoric of quantitative and qualitative research. *Educational Researcher*, 16 (7), 16-21.
- Firestone, W. A., Monfils, L. F., Hayes, M., Polovsky, T., Martinez, M. C., Hicks, J. E. (2004). The principal, test preparation, and educational reform. In W. Firestone, R. Y. Schorr, & L. F. Monfils (Eds.), *Teaching to the test: Standards, assessment, and educational reform* (pp. 91-112).

- Firestone, W. A., Mangin, M. M., Martinez, M. C., & Polovsky, T. (2005). Leading coherent professional development: a comparison of three districts. *Educational Administration Quarterly*, 41 (3), 413-448.
- Firestone, W. A., & González, R. A. (2007). Culture and processes affecting data use in school districts. *Yearbook of the National Society for the Study of Education*, 106 (1), 132–154.
- Goldstein, J. (2003). Making sense of distributed leadership: The case of peer assistance and review. *Educational Evaluation and Policy Analysis*, 25 (4), 397-421.
- Goren, P. (2012). Data, data, and more data—What’s an educator to do? *American Journal of Education*, 118 (2), 233-237.
- Halverson, R., Grigg, J., Prichett, R., & Thomas, C. (2007). The new instructional leadership: Creating data-driven instructional systems in school. *Journal of School Leadership*, 17 (2), 159-194.
- Hatch, T., & Roegman, R. (2012). Out of isolation: Superintendents band together to improve equity and instruction in their districts. *Journal of Staff Development*, 33 (6), 37-41.
- Henning, J. E. (2006). Teacher leaders at work: Analyzing standardized achievement data to improve instruction. *Education*, 125(4), 729-737.
- Herman, J., & Gribbons, B. (2001, February). *Lessons learned in using data to support school inquiry and continuous improvement: Final report to the Stuart Foundation* (CSC Technical Report, 535). Los Angeles: Center for the Study of Evaluation, University of California.
- Holt, M. (1993). Dr. Deming and the improvement of schooling: No instant pudding.” *Journal of Curriculum and Supervision* 9 (1), 6-23.

Honig, M. I., & Venkateswaran, N. (2012). School-central office relationships in evidence use:

Understanding evidence use as a systems problem. *American Journal of Education*, 118 (2), 199-222.

Hunterdon Central Regional High School. History. Retrieved October 7, 2013, from

<http://www.hcrhs.k12.nj.us/about-hc/about-hc/history/index.aspx>

Ingram, D., Louis, K. S., & Schroeder, R. E. (2004). Accountability policies and teacher decision

making: Barriers to the use of data to improve practice. *Teachers College Record*, 106 (6), 1258-1287.

James-Ward, C., Fisher, D., Frey, N., & Lapp, D. (2013). *Using data to focus instructional improvement*. Alexandria, VA: ASCD.

Kerr, K. A., Marsh, J. A., Ikemeto, G. S., Darilek, H., & Barney, H. (2006). Strategies to promote data use for instructional improvement: Actions, outcomes, and lessons from three urban districts. *American Journal of Education*, 112 (4), 496-520.

Knapp, M. S., Swinnerton, J. A., Copland, M. A., & Monpas-Huber, J. (2006). *Data-informed leadership in education*. Seattle: Center for the Study of Teaching and Policy.

Kohn, A. (1993). Turning learning into a business: Concerns about total quality. *Educational Leadership* 51 (1), 58-61.

Kronley, R. A., Suggs, C. H., & Swett, K. S. (2010). *The Panasonic Foundation @ 25 years*.

Newark, NJ: Panasonic Foundation. Retrieved August 20, 2013, from

http://www.panasonicfoundation.net/sites/all/themes/panasonic/pdfs/panasonic_final%2025th%20Anniversary.pdf

Larocque, M. (2007). Closing the achievement gap: The experience of a middle school. *The Clearinghouse*, 80 (4), 157-161.

- Little, J. W. (1990). The persistence of privacy: Autonomy and initiative in teachers' professional relations. *Teachers College Record*, 91 (4), 509-536.
- Little, J. W. (2012). Data use practice among teachers: The contribution of micro-process studies. *American Journal of Education*, 118 (2), 143-166.
- Little, J. W., & Curry, M. (2008). Structuring talk about teaching and learning: The use of evidence in protocol-based conversation. In L. Earl and H. Timperley, *Professional learning conversations: Challenges in using evidence for improvement*. New York: Springer.
- Little, J. W., Gearhart, M., Curry, M., & Kafka, J. (2003). Looking at student work for teacher learning, teacher community, and school reform. *Phi Delta Kappan* 83 (11), 184-92.
- Lortie, D. C. (1975). *Schoolteacher: A sociological study*. Chicago: The University of Chicago Press.
- Love, N., ed. (2009). *Using data to improve learning for all*. Thousand Oaks, CA: Corwin.
- Luo, M. (2008). Structural equation modeling for high school principals' data-driven decision making: An analysis of information use environments. *Educational Administration Quarterly*, 44 (5), 603-634.
- Mandinach, E. B., Rivas, L., Light, D., Heinze, C., & Honey, M. (2006, April). *The impact of data-driven decision making tools on educational practice: A systems analysis of six school districts*. Paper presented at the annual meeting of the American Educational Research Association, San Francisco.
- Mason, S. A. (2003, April). *Learning from data: The role of professional learning communities*. Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, IL.

McLaughlin, M. W. (1992). How district communities do and do not foster teacher pride.

Educational Leadership, (September), 33-35.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis*. Thousand Oaks, CA: SAGE.

Monfils, L. F., Firestone, W. A., Hicks, J. E., Martinez, M. C., Schorr, R. Y., & Camilli, G.

(2004). Teaching to the test. In W. Firestone, R. Y. Schorr, & L. F. Monfils (Eds.),

Teaching to the test: Standards, assessment, and educational reform (pp. 37-61).

Mooney, J. (2013). New Jersey schools largely choosing the same teacher evaluation model.

Hechinger Report. Retrieved January 3, 2014, from

http://hechingerreport.org/content/new-jersey-schools-largely-choosing-the-same-teacher-evaluation-model_11254/

Mountford, M. (2004). Motives and power of school board members: Implications for school

board-superintendent relations. *Educational Administration Quarterly*, 40 (5), 704-741.

Nelson, B. S., & Sassi, A. (2000). Shifting approaches to supervisions: The case of mathematics

supervision. *Educational Administration Quarterly*, 36 (4), 553-584.

New Jersey Department of Education. (2004). NJ Department of Education district factor groups

(DFG) for school districts. Retrieved September 3, 2013, from

<http://www.state.nj.us/education/finance/sf/dfg.shtml>

New Jersey Department of Education. (2006). *New Jersey's plan for meeting the highly-qualified*

teacher goal. Trenton, NJ: New Jersey Department of Education.

New Jersey Department of Education. (2012). Peer school methodology white paper. Retrieved

October 25, 2013, from <http://education.state.nj.us/pr/PeerMethodologyWhitePaper.pdf>

New Jersey Department of Education. (2013). AchieveNJ: Educator evaluation and support.

Retrieved February 10, 2014, from

<http://www.state.nj.us/education/AchieveNJ/intro/guide.pdf>

No Child Left Behind Act of 2001. *Pub. L. No. 107-110*.

Northwest Evaluation Association. Measure of academic progress. Retrieved August 3, 2013

from <http://www.nwea.org/products-services/assessments/map%C2%AE>

Patton, M. P. (2002). *Qualitative research & evaluation methods*. Thousand Oaks, CA: SAGE.

Payne, R. (2003, July). How do you develop and measure intellectual capital in school systems (buildings and districts)? *Instructional Leader*, 16 (4). Retrieved December 1, 2008 from <http://www.tepsa.org/Publications/PDF/RubyPayneIII.pdf>

President signs landmark No Child Left Behind education bill. (2002). Retrieved April 20, 2010, from <http://georgewbush-whitehouse.archives.gov/news/releases/2002/01/20020108-1.html>

Rutgers University Libraries. Popular literature vs. scholarly peer-reviewed literature: What's the difference? Retrieved January 3, 2014, from http://www.libraries.rutgers.edu/scholarly_articles

Schmoker, M. (2003). First things first: Demystifying data analysis. *Educational Leadership*, 60 (5), 22-24.

Schmoker, M. (2006). *Results now: How we can achieve unprecedented improvements in teaching and learning*. Alexandria, VA: ASCD.

Slotta, J. D., Chi, M. T. H., & Joram, E. (1995). Assessing students' misclassification of physics concepts: An ontological basis for conceptual change. *Cognition and Instruction*, 13 (3), 373-400.

Solution Tree. Professional development that builds schools where all children learn. Retrieved October 3, 2013, from <http://www.solution-tree.com/>

Spillane, J. P. (1999). External reform initiatives and teachers' efforts to reconstruct their practice: the mediating role of teachers' zones of enactment. *Journal of Curriculum Studies, 31* (2), 143-175.

Spillane, J. P., Halvorson, R., & Diamond, J. B. (2001). Investigating school leadership practice: A distributed perspective. *Educational Researcher, 30* (3), 23-28.

Spillane, J. P., Reiser, B. J., & Reimer, T. (2002). Policy implementation and cognition: Reframing and refocusing implementation research. *Review of Education Research, 72* (3), 387-431.

Strauss, A. L. (1987). *Qualitative analysis for social scientists*. Cambridge, UK: Cambridge University Press.

Strauss, A. L., & Corbin, J. M. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Thousand Oaks, CA: SAGE.

Supovitz, J. A., & Klein, V. (2003). *Mapping a course for improved student learning: How innovative schools systematically use student performance data to guide improvement*. Philadelphia, PA: Consortium for Policy Research in Education, University of Pennsylvania.

Thornton, B., Shepperson, T., & Canavero, S. (2007). A systems approach to school improvement: Program evaluation and organizational learning. *Education, 128* (1), 48-55.

- Timperley, H. (2008). Evidence-informed conversations making a difference to student achievement. In L. Earl and H. Timperley, *Professional learning conversations: Challenges in using evidence for improvement*. New York: Springer.
- United States Department of Education. (2009). *Race to the Top program executive summary*. Washington, DC: United States Department of Education.
- United States Department of Education. (2012). Section VII—teacher evaluation and development. Retrieved December 20, 2013, from <http://www.ed.gov/teaching/national-conversation/vision/section-vii-teacher-evaluation-and-development>
- Wayman, J. C. (2005). Involving teachers in data-driven decision making: Using computer data systems to support teacher inquiry and reflection. *Journal of Education for Students Placed at Risk*, 10 (3), 295-308.
- Wayman, J. C., & Stringfield, S. (2006). Data use for school improvement: School practices and research perspectives. *American Journal of Education*, 112(4), 463-468.
- Weick, K. E. (1995). *Sensemaking in organizations*. Thousand Oaks, CA: Sage Publications.
- Yin, R. K. (2003). *Case study research: Design and methods*. Thousand Oaks, CA: Sage Publications.
- Young, Viki M., and Debbie H. Kim. (2010). Using assessments for instructional improvement: A literature review. *Education Policy Analysis Archives*, 18 (19). Retrieved December 20, 2013 from <http://epaa.asu.edu/ojs/article/view/809>
- Ysseldyke, J., & Bolt, D. M. (2007). Effect of technology-enhanced continuous progress monitoring on math achievement. *School Psychology Review*, 36 (3), 453-467.

Ysseldyke, J., Spicuzza, R., Kosciulek, S., Teelucksingh, E., Boys, C., & Lemkuil, A. (2003).

Using a curriculum-based instructional management system to enhance math achievement in urban schools. *Journal of Education for Students Placed at Risk*, 8 (2), 247-265.

Appendix A: Participant Consent Form

Attachment 4: Informed Consent Form

Secondary English and Mathematics Teachers Describe Data-driven Decision Making Rutgers University Graduate School of Education

You are invited to participate in a research study that is being conducted by Jeffrey Moore, who is a graduate student in the Graduate School of Education at Rutgers University. The purpose of this research is to determine if English and math teachers on the high school level approach data use in different ways, or have different perceptions of the factors that help and/or impede their data use.

Approximately 21 subjects between the ages of 21 and 65 years old will participate in the study, and each individual's participation will last approximately 30 minutes. Participation in this study will involve responding to questions in an oral interview.

This research is confidential. The research records will include some information about you and this information will be stored in such a manner that some linkage between your identity and the response in the research exists. Some of the information collected about you includes the school in which you work and the subject (Mathematics or English) that you teach. Please note that we will keep this information confidential by limiting individual's access to the research data and keeping it in a secure location.

The research team and the Institutional Review Board at Rutgers University are the only parties that will be allowed to see the data, except as may be required by law. If a report of this study is published, or the results are presented at a professional conference, only group results will be stated. All study data will be kept for three years.

There are no foreseeable risks to participation in this study. The only benefit of taking part in this study is the opportunity to participate in an informed debriefing of the study's results. However, you may receive no direct benefit from taking part in this study.

Participation in this study is voluntary. You may choose not to participate, and you may withdraw at any time during the study procedures without any penalty to you. In addition, you may choose not to answer any questions with which you are not comfortable.

If you have any questions about the study or study procedures, you may contact myself:

Jeffrey Moore
Freehold Regional High School District
11 Pine Street
Englishtown, NJ 07726
(732) 792-7300 x. 8507
jmoore@frhsd.com

Or, you can contact my advisor:

Dr. William Firestone
Rutgers Graduate School of Education
10 Seminary Place
New Brunswick, NJ 08901
(732) 932-7496
william.firestone@gse.rutgers.edu

If you have any questions about your rights as a research subject, you may contact the IRB Administrator at Rutgers University at:

Rutgers University, the State University of New Jersey
Institutional Review Board for the Protection of Human Subjects
Office of Research and Sponsored Programs
3 Rutgers Plaza
New Brunswick, NJ 08901-8559
848-932-0150
humansubjects@orsp.rutgers.edu

You will be given a copy of this consent form for your records.

Sign below if you agree to participate in this research study.

Subject (Print) _____ Subject Signature _____ Date _____

Principal Investigator Signature _____ Date _____

APPROVED
Date: 4/3/12

TEACHER USE OF DATA
Rutgers University Graduate School of Education

Audiotape Addendum

You have already agreed to participate in my research study entitled "Secondary English and Mathematics Teachers Describe Data-driven Decision Making" conducted by Jeffrey Moore. We are asking for your permission to allow us to audiotape as part of that research study. You do not have to agree to be recorded in order to participate in the main part of the study.

The recording will be used for analysis by the research team.

The recording will include your school and subject area (Mathematics or English), but will not include any other identifying information.

The recording(s) will be stored on a computer requiring a confidential access code. All data will be deleted after three years.

Your signature on this form grants the investigator named above permission to record you as described above during participation in the above-referenced study. The investigator will not use the recording(s) for any other reason than that/those stated in the consent form without your written permission.

Subject (Print) _____ Subject Signature _____ Date _____

Principal Investigator Signature _____ Date _____

APPROVED
Date: 4/3/12

Appendix B: Teacher Interview Protocol

Introduction

Thank you for agreeing to meet with me. I am conducting research on how high school math and English teachers use data to make instructional decisions--what data teachers use, where they get it, and what they do with it. "Data" represent all kinds of evidence about students, including their achievement, attendance, or any other information that you collect and then analyze in order to understand how they are doing, and what you should do in the classroom to teach them. This interview will cover 10 questions and take approximately 30 minutes.

Interview Questions:

1. If visitors were to come to your school, what would you be eager to show them about how teachers measure learning?

Probes:

- a. What do you believe that your school does that others do not with regard to data?
2. Here are several different activities that teachers do. What do you do in each of these activities that you would call "data-driven decision making?"
 - Lesson Planning
 - Assessment of Student Learning
 - Classroom Teaching
 - Working with Parents and the Community
 - Professional Development
 - School Improvement
3. Think of a favorite lesson. What are a few things that you do to understand whether students have achieved what you wanted them to achieve?

Probes:

- a. A teacher might have a do-now on the board at the beginning of class, do an exit-ticket at the end of class, assign homework, and give a quiz or test on a particular lesson. How do those compare to the things that you do to collect evidence?

4. What kinds of information do you collect about your students outside of your classroom?

Probes:

- a. What do you want to know about their performance in other classes, past and present?
- b. What do you want to know about non-academic activities? What do you learn from that information?

5. Give me an example of when you've worked with other teachers to discuss student progress in your class.

Probes:

- a. What kinds of information do you share when you discuss student progress in your classes with other teachers?
- b. Tell me what those conversations typically look and sound like: who is in the group, any specific rules or protocols to organize the conversation, etc.

6. Do you feel that you have access to too little, just enough, or too much information about how your students are doing? Why?

Probes:

- a. What other kinds of information would you want?
- b. What useless information do you have?

7. What makes it easy for you to get and analyze information about how students are doing?

Probes:

- a. Tell me about software or any other tools that you use to gather and analyze information.
- b. Tell me about any "go-to people" who can provide information that you can't get yourself.
- c. Do you feel that the software and other tools that you use to gather and analyze information are too hard or easy enough to use? Why?

8. What makes it hard to get and work with information about how your students are doing?

Probes:

- a. Who stands in your way?
- b. What other things stand in your way?

9. How do you think your answers to these questions would compare to the answers of the typical member of your department?

Probes:

- a. What do you do that you think most other teachers do not do?
- b. What do most other teachers do that you do not do?

10. How do you think your answers to these questions would compare to the answers of the typical teacher over in the [math | English] department?

Probes:

- a. What similar activities do you think they engage in?
- b. What are the differences?
- c. What do you think accounts for the differences?

Appendix C: Supervisor/Administrator Interview Protocol

Introduction

Thank you for agreeing to meet with me. I am conducting research on how high school math and English teachers use data to make instructional decisions--what data teachers use, where they get it, and what they do with it. "Data" represent all kinds of evidence about students, including their achievement, attendance, or any other information that teachers collect and then analyze in order to understand how students are doing, and what should be done in the classroom to teach them. This interview will cover 10 questions and take approximately 30 minutes.

Interview Questions:

1. If visitors were to come to your school, what would you be eager to show them about how teachers measure learning?

Probes:

- a. What does your school do that others do not with regard to data?

2. Where does "data-driven decision making" fit into this school's efforts to meet its goals?

Probes:

- a. What data are important to measuring how well the school is doing?
- b. What data do the school collect, and what data come from the district office or other sources?

3. Would you say that data-driven decision making is an important part of few, some, most, or all of the school's efforts to improve?

Probes:

- a. Describe an example in which you think data played a pivotal role in a project's success.
- b. Tell me about any times that you feel data collection and/or analysis impeded a project.

4. What's in place here to help teachers get and analyze information about how students are doing?

Probes:

- a. Tell me about software or any other tools that teachers use to gather and analyze information.
 - b. Tell me about any "go-to people" who can provide information that teachers can't get themselves.
 - c. Do you feel that the software and other tools that teachers use to gather and analyze information are too hard or easy enough to use? Why?
5. What makes it hard for teachers to get and work with information about how their students are doing?

Probes:

- a. Who stands in teachers' way?
 - b. What other things stand in their way?
6. Do you feel that teachers have access to too little, just enough, or too much information about how students are doing? Why?

Probes:

- a. What other kinds of information do you think teachers need?
 - b. What useless information do they have?
7. How would you describe your role in facilitating teachers' data-driven decision making?

Probes:

- a. What kinds of data do you provide that they cannot get for themselves?
 - b. What do you do to make time, provide opportunities, or anything else to assist them?
8. How does data-driven decision making factor into a teacher's evaluation in this school?

Probes:

- a. What things, if any, do teachers have to show with data to receive a positive evaluation?
- b. What are the incentives for teachers to work with data?

9. What skills do you think teachers need in order to successfully work with data?

Probes:

- a. What particular technologies should teachers have mastered?
- b. What training, aside from technology, do teachers require?
- c. What other skills or qualities should teacher possess?

10. Do you think that math and English teachers approach data in different ways?

Probes:

- a. What similar activities do you think they engage in?
- b. What are the differences?
- c. What do you think accounts for the differences?