MATHEMATICS TEACHERS' DATA USE IN PRACTICE:
CONSIDERING ACCOUNTABILITY, ACTION RESEARCH, AND AGENCY

By

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ABSTRACT

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The idea of data use as an educational reform strategy has gained significant traction in recent years, but there is limited research that illuminates what actually happens when teachers use data in practice. This study investigates the ways a group of middle school mathematics teachers used data in their classrooms and as part of an action research study group. Employing the theoretical framework for data use developed by Coburn and Turner (2011), this study takes into account multiple, often overlapping, influences on teacher data use, including teacher evaluation policies and teachers' engagement in action research. Drawing on interview and observation data across a full school year, this study seeks to answer questions about *what* data teachers identified as valid evidence, *how* they discussed data and evidence, and what state, district, and school *policies* and *initiatives* might have shaped their understandings of data. Additionally, this study adopts an ecological perspective of agency (Biesta & Tedder, 2007) to investigate how teachers did and did not express agency as a part of their discussions of data use. Findings indicate that the ways teachers used and discussed data were closely tied to the audiences with whom they interacted. The final chapter of this study summarizes the complex ways teachers use data in practice and how these findings relate to prior research. Recommendations are made to clarify perceived meanings of *data* and *data-driven* and the role of action research as an intervention to promote data use is considered. Theoretical contributions of this study are also discussed along with implications for future research.

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in me and sharing his love. And to my daughter, Autumn, for always making me smile and

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

KEY TO ABBREVIATIONS

AY: Academic Year

CCSSM: Common-Core State Standards for Mathematics

DDDM: Data-driven Decision-Making

RQ: Research Question

[word]:   Replaced text such as a referent for clarity or to preserve anonymity

[…]:   Omitted text or speech

[# sec]:   Duration of pause in speech for pauses two seconds or longer

–:   Self-interrupted speech

//:   Overlapping speech

CHAPTER 1: INTRODUCTION

Over the past ten years, there has been widespread press for the use of data in schools, particularly in the United States, Australia, and England. Many federal and state policies mandate the use of data in education (e.g., American Recovery and Reinvestment Act of 2009; No Child Left Behind Act of 2001) and data use is often seen as a key lever for educational improvement. Results are mixed, however, as to whether efforts to increase the use of data in schools are improving teaching practices or student learning (e.g., Confrey & Makar, 2005; Datnow, Park, & Kennedy-Lewis, 2012). Despite consistent calls for using more data and evidence in education, there is relatively little research that provides insight into teachers' specific data use practices or into the ways that school and policy contexts influence those practices (Coburn & Turner, 2012; Little, 2012).

Teachers may use data for a variety of reasons, such as learning more about their students or conducting action research. Current accountability policies commonly require teachers to use particular data to answer questions posed by individuals outside the classroom (e.g., administrators, school boards). Thus, such policies, particularly those tied to teacher evaluation, have the potential to significantly curb teachers' abilities to act as independent agents for instructional improvement in their classes. In contrast, when conducting action research, teachers actively pose their own questions and use data to seek their own answers to problems in their classroom practice. Therefore, examining teachers' navigation of the overlapping contexts of: (a) their school and its accountability policies, and (b) their work as teacher researchers, offers insights into potentially conflicting positions for teachers using data in relation to different audiences.

Additionally, since secondary mathematics teachers have mathematics content knowledge and quantitative reasoning skills to help make sense of data as it is most often presented (e.g., numeric tables, graphs), collaborating with secondary mathematics teachers offers a potentially rich site for examining data use. In particular, secondary mathematics teachers are likely better equipped to make sense of and to value quantitative data than many other teachers (e.g., English teachers). Therefore, secondary mathematics teachers offer an important perspective in understanding what data use means in practice.

This dissertation study explores the ways a group of middle school mathematics teachers used and made sense of data and addresses the following research questions: *(a) What data do teachers notice or identify as valid evidence? (b) How do teachers discuss data and evidence? (c) What policies and initiatives influence teachers' use of data? (d) In what ways do issues of teacher agency surface as teachers discuss data and evidence over time?*

This study contributes to the practice of and research on the teaching and learning of mathematics in multiple ways. First, it provides insight into the nuanced ways mathematics teachers use data in practice. Second, since teachers interact most directly and most consistently with students, they have a unique perspective to add to conversations among administrators and policy-makers regarding instructional policies that affect classrooms. This study informs conversations among educational stakeholders by illuminating the ways teachers use data in practice in schools. Additionally, investigating the ways mathematics teachers use and make sense of data provides critical information to teacher educators, professional developers, and administrators so that they can better support teachers to use evidence to inform their instructional decisions and support their claims, thereby improving the teaching and learning of mathematics for students.

Overview of Forthcoming Chapters

In the next chapter, I present background literature regarding the paradigms of data-driven decision-making and teacher action research, along with literature related to teacher agency and power relations. Chapter 2 also contains a detailed explanation of the theoretical framework that guides this work. In particular, Chapter 2 sets the stage for considering teacher data use as a set of interrelated processes located within a network of multi-leveled influences. In Chapter 3, I describe interview and observation data and the specific analysis procedures that constitute the methods of this study. I describe how the content and character of teachers' data use are captured in this study and how those features are investigated through narrative discourse analyses techniques. In Chapter 4, I provide an overview of the findings from this study as well as an explanation for how the findings were interpreted using the theoretical framework. In Chapter 5, I present findings related to the policy landscape that shaped the meaning of data for participants. These findings suggest that initiatives to promote data-driven decision-making along with teacher evaluation policies at the state, district, and school levels carried implicit messages about what information was considered data and how data should be used. In Chapters 6, 7, and 8, I present findings in the form of portraits of teachers' data use in the micro-contexts of three different audiences: other stakeholders, teachers, and researchers. Throughout these chapters, I interpret narrative excerpts that characterize the ways teachers discussed data and evidence. These findings suggest that teachers use data in complex ways that vary depending on whom they are interacting with. Finally, in Chapter 9, I conclude with a discussion of the findings of this study, connections to other research, directions for future study, and my personal reflections as a new researcher.

CHAPTER 2: BACKGROUND LITERATURE AND THEORETICAL FRAMING

In this section, I review relevant literature to define and frame the central issues of this study, mathematics teachers using data in practice. Specifically, I examine literature related to teacher data use and data-driven decision-making, teacher action research, and teacher agency. I seek to clarify what is meant by teacher data us and outline how expectations for using data may be similar to and different from what teachers do when engaging in their own action research. Additionally, individual agency and contingent power relations play a significant role in any interpretive act, especially those linked to performance evaluations, as is the case with teacher data use within the current focus on teacher evaluation policies. Therefore, I then explore the construct of teacher agency and consider its relation to teacher data use and the related implications for research.

Teacher Data Use

Over the last several decades the notion of data use as an educational reform strategy has gained significant traction, garnering support from major foundations (e.g., Bill and Melinda Gates Foundation, Dell Foundation) and being lauded as the driving force behind educational reform strategies (Duncan, 2009). At the same time, there has been almost no question as to whether an increased focus on data is a good reform strategy, and there has been only limited definition of what it means in practice to use data for educational reform (Jennings, 2012; Roderick, 2012). Coburn and Turner (2011) define the *process of data use* as "what actually happens when individuals interact with assessments, test scores, and other forms of data in the course of their ongoing work" (p. 175). There is much less research that provides details about *what actually happens* than there is

literature and policy encouraging educators to use data to inform their work (Little, 2012; Spillane, 2012).

Data-driven decision-making (DDDM) has been one of the key responses in the United States to the notion that data should be a central part of the work within schools and school districts. DDDM is modeled after practices shown to be successful in industry and manufacturing, which emphasize long-term improvement through measureable, short-term responses to various data (e.g., material costs, production rates, customer opinions) (Marsh, Pane, & Hamilton, 2006). Ikemoto and Marsh (2007) define DDDM in the education context as a process by which administrators and teachers collect and analyze data to guide educational decisions. Building from its roots in industry, Datnow and colleagues (2012) point out that most implementations of DDDM are grounded in a technical-rational perspective, which assumes there is only one definition and interpretation of what it means to use data to inform decision-making. Research indicates, however, that the ways in which educational stakeholders take up data-related activities involve complex relationships and can vary within the same school (Datnow et al., 2012) and across grade levels (Pham, 2011).

Mandinach and colleagues (2006), in their multi-leveled framework for DDDM, highlight the distinctions between *data*, *information*, and *knowledge*, three terms often treated as synonyms in public conversations. Specifically, they emphasize that data exist in a raw form and have no inherent meaning. Therefore, data may or may not be usable, and whether or not data become meaningful information is dependent on the individual interacting with that data. Although most policies focus on educators using data from standardized assessments, teachers, principals and administrators report using a wide

range of data sources to inform their practice, including student attendance and participation information, informal assessments, and personal intuitions (Datnow et al., 2012; Ikemoto & Marsh, 2007; Marsh et al., 2006; Pham, 2011).

Additionally, in this research I also consider the term *evidence* as distinct from data. In particular, evidence, which is based on data, is used with a purpose, and therefore must have been interpreted by the individual using it. In this regard, evidence is used to provide empirical support for a larger argument. Using Toulmin's model (1969), evidence can be seen as the grounds, reasons, or support used to bolster a claim made by an individual.

There have been a number of recent calls for research on data use, including special issues in both the *American Education Research Journal* and *Teachers College Record*. These efforts focus on the need for information on the nuances and complexities in the ways individuals use data in their daily work, especially the interpretive nature of their interactions with data (Coburn & Turner, 2011; Little, 2012; Spillane, 2012). At every step of the process of using data as a part of instruction individuals make value judgments and interpretations, including the decisions of what data to collect and determining what those data mean for instruction. Additionally, social interactions strongly influence the ways individuals use and make sense of data (Daly, 2012). For example, at the district level, Coburn and Yamashita (2009) highlighted the complex and changing roles played by interpretation, persuasion, and power dynamics as related to using evidence. Similarly, at the classroom level, Coburn (2001) illustrated intricate processes in which teachers co-constructed understandings of policy messages and made decisions regarding instruction via formal and informal conversations with their colleagues. These examples illustrate that

moving from policy directives to using educational data is not straightforward and involves

multiple levels of interpretation.

Technology has also played a significant role in the ways data are used in schools. In

particular, easy access to data is a critical first step to stakeholders making use of that data.

A lack of easy access to data, including a lack of technical capacity to facilitate such access,

has been a significant obstacle to data use for many districts (Coburn, Honig, & Stein, 2009;

March et al, 2006). As computer software has become more prevalent and powerful,

technology systems are increasingly capable of accessing and organizing complex data sets

(Wayman & Stringfield, 2006). The term "data warehouse" is often used to describe

technological systems that integrate, store, organize, and make accessible a range of

information into a single location. Wayman and Stringfield (2006) explain, "Data

warehousing integrates data that are often stored in disconnected areas (e.g., student

attendance, discipline, and achievement test data), thus allowing the examination of

relationships across a variety of domains." (p. 553). Data warehouses and computer

information systems are critical tools in the use of educational data. They also contribute to

powerful infrastructures that influence which data matter and how they are used

(Anagnostopoulos, Rutledge, & Jacobsen, 2013).

An important distinction made in the research literature that has been generally

neglected from public discourse is that data to improve instruction is qualitatively different

from data that provides meaningful evidence for evaluating teachers (Weiss, 2012).

Although policy efforts within the broader accountability movement (e.g., Jacobsen &

Young, 2013) include measures to both improve instruction as well as to evaluate teachers,

the data necessary to support these two efforts are distinct. In a detailed review of

literature on the design of assessments, Supovitz (2012) outlined three important characteristics of assessments shown to support teachers' understanding of what students know and can do in a particular content area. The data produced by assessments meeting Supovitz's criteria provide valuable information for teachers seeking to respond to students' changing needs as their understanding develops over the school year. In contrast, the timescale on those same assessments would likely be too limited to provide meaningful information about the effectiveness of the teacher from the perspective of teacher evaluation. Additionally, it is impossible to separate educational data from the context of politics and power structures inherent within schools and the broader educational policy milieu (Henig, 2012).

The expectation that teachers ought to use data and evidence as a central component of their work with students is not new. In fact, examinations of everyday practices of effective teachers illustrate that these teachers regularly gather information from students, interpret, make decisions and respond to the needs of those students as simply part of the practical work of teaching (i.e., Boaler & Humphreys, 2005; Lampert, 2001). An important distinction, however, lies in the framing of how teachers are positioned with respect to that data – Are teachers required to use particular data, or are they independent researchers posing their own questions? To clarify this distinction, in the following section I unpack the notion of teacher action research and its connection to and perspective on teachers using data.

Teacher Action Research

Originally coined by Lewin (1948), action research typically takes the form of a spiraling cycle of planning, action, data collection, and reflection. There is, however, a range

of definitions that have been used to frame action research. For example, Carr and Kemmis (1986) described action research in the following manner:

> Action research is simply a form of self-reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own practices, their understanding of these practices, and the situations in which the practices are carried out (p. 162).

More recently, Mills (2014) defined action research as:

> any systematic inquiry conducted by teacher researchers, principals, school counselors, or other stakeholders in the teaching/learning environment to gather information about how their particular schools operate, how they teach, and how well their students learn. […] Action research is done *by* teachers *for* themselves; it is not imposed on them by someone else. (p. 8)

Action research requires that the role of the researcher be central to the experiences of those being studied (Borko et al., 2008). As Jaworski (1998) described it, action research is "…a way of conceptualising reflective activity which emphasises the resulting action" (sic., p.8). Across the definitions, action research is a paradigm that links reflection and action.

Although action research can occur in a variety of practitioner domains, in this paper I focus exclusively on teacher research. As I refer to it in this proposal, action research falls within the realm of teachers generating *knowledge-of-practice* (Cochran-Smith & Lytle, 1999, p. 250) with the specific purpose of solving problems that they, personally, have identified. Within the action research paradigm, teachers are seen as co-constructors of knowledge working together with colleagues or university researchers. They investigate teaching, curriculum, policies, etc., within the specific context of their

classrooms, schools, and communities. By combining systematic analyses of learning with their intentions, decisions, interpretations, and reflections, action researchers can construct detailed accounts of teaching and learning. In particular, teachers' insider perspectives allow them to develop insights and conclusions unavailable to outside researchers (Borko et al., 2008; Cochran-Smith & Lytle, 2009).

By casting teachers as individuals who pose their own questions and seek their own answers, the action research paradigm positions teachers as active agents within their classrooms. This active positioning of teachers stands in contrast to other more traditional forms of professional development primarily focused on expanding teachers' set of well-defined skills. Many argue that the recognition of practitioners as valid generators of knowledge about their own practice has the potential to challenge the status quo of the educational system. This would provide more equitable educational opportunities for students and empowered experiences for teachers (e.g., Atweh, 2004; Boyle-Baise & McIntyre, 2008; Groenke, 2010; Martin, 2005; Zeichner & Conklin, 2008). It is possible that expectations for teachers to use data and evidence to inform their instruction could be framed to fit within the action research paradigm. Current policies, however, such as those requiring teachers to use data tied to teacher evaluation, have the potential to significantly limit teachers' abilities to act as independent agents.

In light of these potentially contradictory forces, in the following section I discuss the notion of teacher agency. Specifically, I establish a working definition of teacher agency used throughout this research project. I also explore the ways in which teachers' agency can be viewed as a socio-culturally mediated construct and discuss subsequent research implications.

10

Teacher Agency

      Ecological Perspective. The idea of agency appears in a broad range of research

disciplines, including philosophy, psychology, and sociology. Bandura's (2001; 1989) often

cited social cognitive perspective emphasizes the intentionality of one's actions and the

ways in which an individual can engage in reflective regulation of her activity. I begin with

the assumption that human beings have the ability to make individual choices that affect

their lives and environment (Lasky, 2005). I then adopt an *ecological* understanding of

agency (Biesta & Tedder, 2007) that sees agency as a way of interacting with structural

environments instead of a capacity that an individual does or does not possess. Biesta and

Tedder (2007) explain that an ecological understanding of agency highlights that

individuals always act "*by means* of an environment rather than simply in an environment"

(p. 137). They define agency as follows:

> Agency is not some kind of 'power' that individuals possess and can utilise in any
>
> situation they encounter. Agency should rather be understood as something that has
>
> to be achieved in and through engagement with particular temporal-relational
>
> contexts-for-action. Agency, in other words, is not something that people have; it is
>
> something that people do (p.136)

This perspective attends to the ways teachers express their feelings of agency at different

times and in different situations. The same individual may express more or less agency

depending on the various supports and constraints of any particular situation. This

perspective suggests that agency can be expressed as the degree to which individuals are in

control of their responses to problematic situations (Biesta & Tedder, 2007; Emirbayer &

Mische, 1998).

Similarly, Weick (1977) proposed that it is through *enactment* — actively engaging in practices to construct or transform one's environment — that individuals come to understand their environment. Accordingly, since contexts for learning shape how individuals experience agency, it is necessary to develop situated accounts of teachers' agency as related to their professional learning (Riveros, Newton, & Burgess, 2012).

Using the lens of ecological agency is important for this study because it supports a focus on context, in this case the context for teachers' data use. My review of literature, however, did not uncover any studies directly related to teacher agency that utilized an ecological perspective. The following section explores current, albeit limited, discussions of teachers' expressions of agency.

Research on Teacher Agency. Considering the ecological perspective of agency discussed above, it makes sense that most literature on teacher agency is focused on educational change efforts, particularly teachers' responses to policy reforms. Some studies focus on the ways teachers are able to act as change agents within curriculum efforts (Oliveira, 2012; Priestley, Edwards, Priestley, & Miller, 2012). Others focus on teachers' perceptions of their agency within broader reform efforts (Datnow, 2012; Ketelaar, Beijaard, Brok, et al., 2012; Pyhältö et al., 2013; Riveros et al., 2012; Vähäsantanen, Saarinen, & Eteläpelto, 2009). Across these studies it is clear that teachers' agency: (a) was influenced by a variety of factors and (b) played an important role in whether or not teachers changed their instruction practices.

For example, Pyhältö and colleagues (2013) worked with teachers in Finland consistently across a two-year period to support teachers to see themselves as active agents in terms of school reform. Their efforts resulted in teachers developing more

holistic and complex understandings of the school reform efforts. They also observed more

teachers identifying as active participants in reform efforts (*subjects* of the reform) rather

than passive *objects* upon which the reform was being imposed. Additionally, this study

revealed the development of *teachers' professional agency* — defined as intentionally

managing new learning at an individual and community level, including using others as an

intentional resource for learning, as well as supporting the learning of others. The study

showed teachers' professional agency in school reform was: (a) shaped by social

interactions, (b) varied related to the ways individuals made meaning of reform, and (c)

was under constant negotiation. Pyhältö and colleagues also concluded that in order to

facilitate teachers' professional agency particular attention should be paid to the dynamics

of how teachers' personal perceptions fit with their work environment. They also found

that professional agency served as a valuable tool to analyze the complexity of teacher

learning and educational change efforts.

These results are also supported by the work of Ketelaar and colleagues (2012). In

their study of how teachers responded to a reform requirement to assume a coaching role

with students, Ketelaar et al. found that teachers' agency was correlated with the

ownership they felt towards the reform effort and how they made sense of the reform.

They drew on Datnow (1998) to conceptualize teachers with a high degree of agency as

those with the "capacity to change the existing state of affairs" (p. 992). They also explained

that in order for teachers to feel in control of their work-related choices, they require a

certain degree of autonomy within their school. Ketelaar and colleagues examined the

following indicators in teachers' interview responses: teachers' goals, school goals,

teachers' goals vs. school goals, teachers choices, and teachers' activities performed to

reach their goals. These indicators were used to determine whether teachers experiences high, moderate, or low feelings of agency.

Lasky's (2005) case studies of teachers illustrated that conflicts between teachers' professional identity and reform mandates can negatively influence their feelings of agency. As a converse to agency, Lasky described *vulnerability* as when individuals "have no direct control, believe they have no direct control over factors that affect their immediate context, or feel they are being 'forced' to act in ways that are inconsistent with their core beliefs and values" (p. 901). Lasky found that the ways teachers identified as professionals and how they interacted with students could be at odds with the ways they interact with administrators as a part of reform efforts.

Power Relations

The ways that teachers do or do not experience agency are complex and interrelated. In order to understand the dynamics of teachers' agency, it is necessary to: (a) study teachers situated within their professional contexts and (b) take into account the ways that agency is socially mediated and impacted by existing systems of power. In line with the position expressed by Zeichner and Noffke (2001) in the quote below, I assume that all forms of teaching and educational research are inherently political.

> Works that are silent on issues of racial equality, for example, assume political positions as much as those that explore the meaning of such issues. Works that take unproblematized stances toward the role of teachers, the nature of curriculum, or that processes of learning are likewise political and representative of particular educational positions. (p. 309)

Zeichner and Noffke highlight the fact that political issues of equity and power are constantly at play in all interactions. Similarly, Burbules (1986) describes power as a web of relations, "as inherent in the framework of a status quo: in the exercise of presumed privilege, in habit and apathy, and in unquestioned authority and organizational roles" (pp. 103-104). In any social interaction, power relations, or the dependence of one individual or group upon another, are occurring (Emerson, 1962).

From a political perspective, data are "first and foremost a source of power and influence" for policy-making (Henig, 2012, p. 6). Public schools are in the public domain, and thus, they are subject to competing interests from both inside and outside the school district. Such interests bring with them competing values that can pressure administrators and teachers to attend to certain data for certain purposes. For example, Anagnostopoulos, Rutledge, and Jacobsen (2013) illustrate the vast network of individuals linked to test-based accountability systems, including private foundations, consultants, computer firms, and testing companies, each of whom vies to exert power and draw attention to their own interests.

Specifically, power relations around data might include test companies lobbying for more data expectations that include standardized test scores because those companies stand to benefit from school districts being required to use their tests. Similarly, textbook companies that tailor their curriculum materials to relate to particular tests can benefit from increased focus on those same tests. Then those companies might push for policies that require data from the tests to which their textbooks are tied. Additionally, if schools are required to report on a range of complex data such as many test scores, attendance, and teacher evaluations, then computer software is needed to manage that data, training on

15

that software is needed, computer systems need to be upgraded and fitted with specific software, etc. Thus, computer firms have a stake in public schools using particular data in particular ways, as well. In general, data use, as a part of accountability policy, opens the door for outsiders to exert power and to closely monitor and control classroom instruction (Anagnostopoulos et al., 2013).

At the school level, teachers, administrators, and students do not necessarily submit passively to outside influences of power. In fact, an increasing number of studies indicate that schools and teachers attempt to use their own power to game the system in an effort to increase test scores without engaging in significant instructional changes (e.g., Abedi, 2004; Cullen & Reback, 2006; Figlio & Getzler, 2006; Kieffer, Lesaux, & Snow, 2005; Porter, 2015). Many news stories and online forums also share instances of individuals speaking back against power of accountability policies they see as unfair using methods such as opting out of required standardized testing (e.g., Smith, 2016; Taylor, 2016).

Henig (2012) described the ways data are used often reshape school power both internally and externally. Discussing the idea of interconnected power relations around data he defined complex *data regimes*. A data regime, Henig explained,

> comprises not just a particular set of indicators and the systems in which they might be embedded but also the array of *animating ideas* (e.g., theories about the relative influence of teachers or of nonschool factors), *supporting interest groups* (e.g., political and policy entrepreneurs who promote the data systems; for-profit and nonprofit organizations that collect, disseminate, analyze the data), and the governance *institutions* (e.g., mayoral control, federalism) that enable those to take hold and flourish (p. 6).

In this perspective, power relations related to data move beyond the level of individuals to include institutional and even cultural levels of influence. As a result, power relations are entrenched and often implicit or taken for granted. Any consideration of teachers' data use and agency is influenced by the omnipresent power dynamics within which teachers live and work.

In the following sections I describe the theoretical framing for this research and then discuss the scope and purpose of this study.

Theoretical Framework

There is a need for more clarity on the specific ways in which teachers use data and evidence in practice and this research proposal seeks to address that need. In a similar effort, Coburn and Turner (2011) developed a detailed theoretical framework to support the understanding of how teachers use data in practice (Figure 2.1). Their framework includes four interrelated categories: (1) interventions to promote data use, (2) organizational and political context, (3) processes of data use, and (4) potential outcomes. This framework supports the notion that teachers' use of data is a complex and situated process that is shaped by a variety of factors and interactions between factors. Coburn and Turner (2011) described a detailed analysis of the individual components of each category of this framework and the ways they relate to existing literature on data use. Here I briefly unpack the four main categories of the framework that are used to guide the methods of this research. In subsequent chapters, I use these categories to organize and interpret the findings of this study.

Interventions to
promote data use

- tools
- comprehensive data initiatives
- accountability policy

**Organizational and
political context**

- routines   • time
- access to data   • norms
- leadership   • power relations

**Processes of
data use**

- noticing
- interpreting
- constructing
  implications

Potential outcomes

- organizational change
- change in practice
- student learning
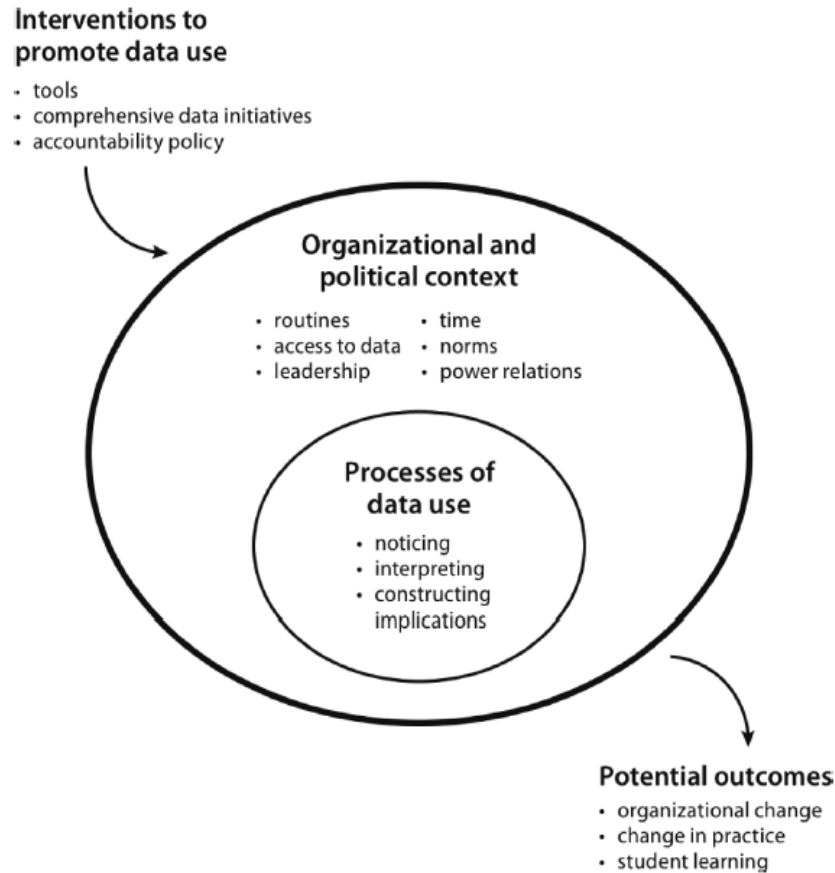
Figure 2.1. Framework for Data Use (Coburn & Turner, 2011, p. 176)

Interventions to promote data use

Over the past ten years, there has been a wide range of interventions to promote

data use in schools, many of which likely resulted from corresponding policies at national,

state, and local levels. Interventions can take many forms. Coburn and Turner's review of

literature outlined the three following categories of interventions: (a) tools, such as

technological data management systems, rubrics, or standardized assessments; (b)

comprehensive initiatives, which typically include multiple tools and/or technologies in

combination with professional development for teachers; and (c) accountability policies,

which are based on assumptions that sanctions and rewards tied to data will increase data

use and motivate educators to improve performance.

Much has been written about how to implement such initiatives including advice or how-to guides for using data in schools (e.g., Bernhardt, 2004; Boudett, City, & Murnane, 2013). Marsh's (2012) thorough review of literature on interventions to promote data use identified a variety of practices that showed promise for supporting teachers to use data, including: (a) making data useable and safe for teachers; (b) targeting multiple leverage points within the educational system; (c) collaboration across departments and levels of organization (i.e., grade levels; teachers, administrators and district personnel). Additionally, Marsh found persistent challenges across interventions including the difficulty of developing and sustaining support for teachers.

In Figure 2.1, Coburn and Turner depict the category *Interventions to Promote Data Use* as an input into the data-use system. In this conception, interventions might spark teachers to use data in new or different ways. Alternatively, intervention might also constrain or control the ways teachers use data. In all cases, the influences of particular data use interventions are filtered through the broader contexts of the environments to which they are applied.

Organizational and political context

The ways that teachers use data occur within broader structures at the organizational, political, and societal levels. What teachers observe, how they interpret, and their subsequent decisions and actions are all subject to the norms, expectations, opportunities, and constraints created by the broader contexts in which they take place (Lave & Wenger, 1991). Researchers have historically identified that the ways teachers perceive the world as constructed via individuals' lenses that are influenced by their prior experiences and beliefs (e.g., Gibson, 1979; Lortie, 1975). Likewise, the data that teachers

encounter is also viewed through those same lenses. Additionally, data processes are a part

of politicized environments that span the potentially conflicting interests of a range of

stakeholders (Henig, 2012).

The Coburn and Turner framework, Figure 2.1, depicts this category as an oval

surrounding the processes of data use. Although this category could have been represented

by region within which all of the other categories are also housed, in Coburn and Turner's

construction, it focuses on school and district level factors. The opportunities and

structures in place in schools profoundly shape the daily practices of teachers. For example,

organizational routines establish priorities about what is worth noticing in classrooms and

in data and frame interactions around data (Spillane, 2012). Similarly the time and access

teachers have to data impact the ways in which they use it. Power relations and leadership

also play significant roles in determining the ways that teachers use and make sense of the

information they have about students (Earl, 2009; Henig, 2012; Marsh, 2012).

Clarifying the Meaning of Context. In this study, I recognize that a wide range of

factors, including those described above, comprise the *context* for teachers' everyday work.

Additionally, within that broader context, there exist micro-contexts, such as the particular

individuals with whom teachers are interacting, the *audience* of their data use. Using a

sociolinguistic and sociocultural perspective (e.g., Gee, 2014) I recognize that the ways

teachers use language to describe their data use are influenced by contexts both macro and

micro. Likewise, I understand an individual's communication and their context to mutually

constructed or *reflexive* (Gee, 2014). So, when I examine the ways teachers discuss data and

evidence I recognize that language has *situated meanings* and that what is said influences

what an audience interprets the context to be and similarly, context influences what an audience interprets what is said to mean.

Processes of data use

The most central component of this framework is the processes of data use, the practices in which teachers engage when they interact with data. Most current policies that mandate using data in education do not specify what is meant by "using data." Assumptions about the implicit meanings and processes involved in using data for education often leave the inner workings of data use ambiguous and unarticulated. In contrast, Coburn and Turner (2011) highlight three processes that are essential to using data: *noticing*, *interpreting*, and *constructing implications*. Here I outline the ways these types of activities are understood in the context of this study.

The processes of data use begin even before any information is collected because before data collection occurs, teachers first attend to particular issues. That is, the processes of data use begin with the activity of *noticing*. Teachers can notice a wide range of data, such as student interaction patterns, features of student written work, or student test scores. As synthesized by Coburn and Turner (2011), the elements of classroom practice to which teachers attend begin to shape the ways in which teachers later engage with those elements as data to be collected and analyzed.

Within the context of mathematics education, there is a rich body of research on teacher noticing. Across the research, there is a range of definitions for *noticing* (e.g., Jacobs, Lamb, & Phillips, 2010; Santagata, Zannoni, & Stigler, 2007; Star & Strickland, 2007; van Es & Sherin, 2011). All definitions, however, include elements of how individuals make sense of complex situations. The same applies to noticing as a process of data use.

Classroom and school environments are rich and complex sources of much data, and different teachers notice different data in different ways.

Similar to Coburn and Turner's (2011) three processes of data use, Jacobs and colleagues (2010) defined teachers' *professional noticing of children's mathematical thinking* as the set of three interrelated skills: (a) attending to children's strategies, (b) interpreting children's understandings, and (c) deciding how to respond on the basis of children's understandings" (p.172). Jacobs and colleagues identify all three skills as comprising the work of professional noticing. In contrast, Coburn and Turner's framework separates out the processes of attending – which they refer to as *noticing*, interpreting, and deciding how to respond – which they refer to as *constructing implications*. Regardless of whether the processes noticing and interpreting are grouped or separated, however, additional research has shown that what teachers notice and the ways they interpret that information tend to confirm their preexisting beliefs and is filtered through the lenses of their prior experiences (Greeno, Collins, & Resnick, 1996; Spillane & Miele, 2007). For this study, I keep with Coburn and Turner's more simplistic concept of teachers' *noticing* data as distinct from the other processes; here *noticing* does not explicitly include interpretation.

Following Coburn and Turner's model, then, after teachers have noticed particular data, they must then determine what those data actually mean – they must engage in *interpreting* the data. Depending on the type of data, the work of interpretation could require a range of skills including, but not limited to, statistical reasoning. Once teachers understand the meaning of their data, they then go through the process of determining what the data suggest needs to be done – they engage in *constructing implications* or

making decisions based on the data. Possible implications of classroom data might include modifying instruction or regrouping students. By constructing implications, teachers determine what next steps to take based on their data.

Outcomes of Data Use

The final category of Coburn and Turner's (2011) framework highlights the possible effects of using data in schools, the potential outcomes of data use. There has been relatively little research that seeks to link the use of data in schools with outcomes for teachers or students, such as changes in teaching practice or student learning (Coburn & Turner, 2011). There are a number of possible outcomes for different educational stakeholders and Coburn and Turner's framework outlines three categories of outcomes including changes in organizational structures, teaching practices, or student learning.

Changes in organizational structures include changes that persist beyond individuals and that persist in the face of personnel turnover. Research has indicated that iterative data use processes can result in organizational change to policies, organization, and data use routines (e.g., Sherer & Spillane, 2011). Changes in practice are typically the intended consequence of data use interventions. The guiding assumptions behind such policies are that teachers and administrators will examine data and then adjust their practices accordingly to best support student learning. Thereby, changes in student learning are a related outcome of data use.

It is important to note, however, that change is not synonymous with improvement. It may be the case that teachers and administrators attempt to game the system (Helig & Darline-Hammond, 2008) work to narrow the curriculum (Marsh, Hamilton, & Gill, 2008),

or make decisions that maintain or promote inequitable situations for marginalized students (Confrey & Makar, 2003).

Scope and Purpose of the Present Study

Due to the complex realities of schools, any study of data use necessarily foregrounds particular issues and backgrounds others. In this study, by attending to teachers' perspectives, specifically focusing on the ways teachers discussed data and evidence; I fail to attend to other important issues. For example, I do not explicitly attend to students' experiences related to teachers' data use. The question of what it means for student learning when teachers use data is left unanswered here. Similarly, it is possible that the ways teachers used data over the course of the school year had lasting impacts on the school or district, but those outcomes are also not attended to here. These omissions do not indicate that I see these issues as any less important, but rather my specificity in focus was a necessary limitation of the scope of my qualitative inquiry.

The purpose of this study is to deeply explore the ways a group of mathematics teachers use data, including how they notice, collect, and respond to evidence in light of multiple influences including, accountability and DDDM initiatives and their work as teacher researchers as a part of an action research study group. I illustrate the ways a department of middle school mathematics teachers discussed data and evidence over the course of a full school year. I examine *what* data they described as valid evidence and *how* they discussed data and evidence, including interrogating their definitions of *data* and exploring their interactions. I also explore the context for the teachers' data use by examining policies and initiatives that may have influenced their understanding of data. Additionally, I investigate how issues of teacher agency surfaced in relation to data use

throughout the year. In light of the significant, national and international focus on data use as an essential means to improve instruction, there is a pressing need to understand what it means in practice for teachers to use data. In the next chapter, I present the method of analysis I employed in this study.

CHAPTER 3: METHOD

In this chapter I outline the methods I used to conduct this research. First, I describe the participants and setting for the study, including a brief overview of some policies and initiatives that influenced data use context for participants. Then, I discuss the professional development project and action research study group in which the study participants took part, which served as an intervention to promote data use. I then describe my own positionality as the researcher. Finally, I describe the analytical procedures I employed to conduct this research.

Participants and Setting

This study examined the work of four middle school mathematics teachers, Ms. Barton, Ms. Jackson, Mr. Hale, and Ms. Pell, who worked together at Jefferson Middle School[1]. Jefferson Middle School was a culturally, linguistically, socioeconomically, and racially diverse school that served about 700 students in sixth through eighth grades. It was located in the Greenville School District in a suburban neighborhood nearby to a large university in the Midwest United States. The year of this study (AY2014-2015) was the first year that the building included sixth-grade students. Prior to that, Jefferson Middle School included only seventh and eighth grade students. Jefferson Middle School is the only middle school in the Greenville School District. It is fed into by six different elementary schools and is the feeder school to the district's only high school, Greenville High School.

Prior to the addition of the sixth grade to Jefferson middle school, Mr. Hale, Ms. Pell, Ms. Jackson, and Ms. Barton were the only mathematics teachers in the school. Adding sixth grade to the building brought in three additional mathematics teachers. Although these

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[1] All names of the school, district, participants and school personnel are pseudonyms.

three sixth grade teachers participated in the study group sessions, they are not the focus

of this study. I made the decision not to include the sixth grade teachers because they were

not participating in the action research portion of the study group during AY2014-2015.

Instead, the PD Facilitator provided them with some of the same opportunities the seventh

and eighth grade teachers had in prior years to study mathematics classroom discourse.

Similarly, Ms. West the mathematics coach and math interventionist for Jefferson Middle

School also participated in the study group, but was not one of the primary participants of

this study. Her perspective as a coach who engaged with all of the teachers in their own

classrooms was illuminating. Ultimately, however, her data use practices in the role of

coach and interventionist were considerably different from those of the classroom

teachers. She is not one of the primary participants of this study.
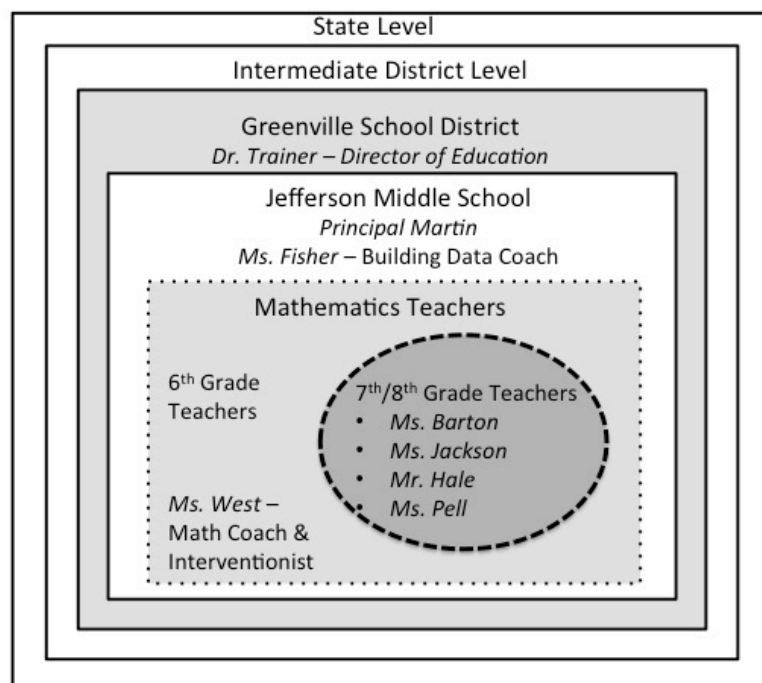
Figure 3.1. Map of Participants and School Structure

Figure 3.1 illustrates the organization of the school system and where the participants of this study fall within the larger structures. The organizational structure of the Greenville School District was such that they had their own superintendent and policies, but additional services, funding, and expectations were dictated through a larger regional "intermediate school district" (ISD) that comprised a total of 12 school districts. Within the state educational system, there were 57 ISDs.

In order to gain a perspective of how data were understood and used at the district level, I interacted with Dr. Trainer[1], the director of education for Greenville School District. Dr. Trainer described her position to include responsibility for a range of matters including all district curriculum and assessment decisions.

At the building level, I also interacted with Principal Martin[1]. Principal Martin had worked in the Greenville School District throughout her entire career, more than 20 years. In fact, she began her career as a mathematics teacher in the Greenville High School before serving as principal for the district middle school many years later. Also at the building level, I spoke with Ms. Fisher[1] the data coach for Jefferson Middle School. She also worked as the school psychologist and had received training through the ISD to become a data coach.

Primary Participants. The four seventh and eighth grade teachers at Jefferson Middle School were the primary focus of this study. Ms. Barton taught eighth grade and was

the most experienced teacher in the group, with nearly 30 years' experience. She

previously worked at the high school in the same Greenville School District, but had been

teaching eighth grade mathematics for most of that time. Ms. Jackson was the other eighth

grade teacher in the school and had been teaching for about nine years, including seven

years working in an alternative school in another district. Mr. Hale taught seventh grade

and was the second most experienced teacher in the group, with more than 20 years'

experience. Mr. Hale had been a teacher at Jefferson Middle School for his entire career. In

addition to teaching mathematics, Mr. Hale was also certified to teach Language Arts, which

he did for two classes during the day for the first time during the year of this study. The

final participant in this study was Ms. Pell, the other seventh grade teacher in the school. At

the time of this study, Ms. Pell had been a full time mathematics teacher for two years,

making her the least experienced teacher in the group. None of the participants had

previously focused on mathematics classroom discourse prior to their work with the

professional development described here, but all demonstrated enthusiasm for the PD and

expressed a positive learning disposition and a desire to innovate and improve their

practice.

      Overview of Data Use Policies and Initiatives. State, district, and school policies

and initiatives around data use are important features of the setting for this study. In

general, policies and initiatives around accountability and evidence-based efforts shape the

data use context for teachers by influencing what data were prioritized and expectations about how data should be used. Here, I briefly describe some of the teacher evaluation policies and data-driven decision-making (DDDM) efforts across the school system that helped to shape the setting for data use in this study.

At the state level, DDDM initiatives centered on technological influences, including data management software and publicly available data online. At the time of this study, the primary initiatives had been in place for multiple years. Teacher evaluation policy was written into law at the state level and included specific attention to data measuring student growth. Schools and districts then interpreted those state requirements as they enacted teacher evaluation policies.

At the district level, DDDM initiatives also focused on data management software. Additionally, the district provided professional development "data days" to support teachers to access data via the data software systems. Teacher evaluation policies included measures of general pedagogical practice using a district-created rubric and expectations for using data to measure student growth that varied by school.

Lastly, at the school level, additional data days were provided to encourage teachers to examine particular data produced using the data management software. Teacher evaluations were conducted using the district evaluation tool for pedagogical practices. Student growth was measured using teacher-assigned course grades and semester assessment scores. The pedagogical practices comprised 75% of the evaluation and the student growth measures comprised the remaining 25% of the evaluation.

Together, these multiple levels of policies and initiatives help to shape what data meant for teachers at Jefferson Middle School and set implicit and explicit expectations for

how teachers should use data. The details of these policies and initiatives are discussed in detail in Chapter 5: *Exploring Data-Driven Decision-Making Initiatives and Teacher Evaluation Policies and the Meaning of Data*.

Interventions to promote data use

In this study there were multiple interventions that had the potential to promote data use. As described above, in the years preceding this study the Greenville School District invested in several tools to support teachers to use data, including data management software (i.e., Illuminate Ed) and a system of standardized formative assessments (i.e., Aimsweb). The intervention most salient to this research, however, was a three-year professional development (PD) experience and action research study group focused on mathematics classroom discourse. Here I discuss the features of this professional development experience, including its focus and methods.

MDISC Professional Development and Action Research Study Group. All four participants collaborated with me and another university researcher, whom I refer to here as the PD Facilitator, beginning in academic year 2012-2013 to pilot professional development materials called *Mathematics Discourse in Secondary Classrooms* (MDISC, c.f., Herbel-Eisenmann, Cirillo, Steele, Otten, & Johnson, Under Contract). This first year of the PD comprised 36-hours of study group sessions facilitated by the PD facilitator using the MDISC materials. Subsequently, the group began cycles of action research during 2013-2014, first working collaboratively on group interests related to the PD content, and later in 2014-2015 moving to focus on individual action research projects.

The goals of the MDISC materials were to support teachers in becoming *purposeful* about developing *productive* and *powerful* classroom discourse. That is, the MDISC

materials built from research that showed that as participants learn about, contemplate, and discuss classroom discourse, they become more purposeful about how they can use classroom discourse practices (Herbel-Eisenmann & Cirillo, 2009) that are both productive and powerful for student learning. The authors of the materials describe *productive* as the ways in which participants' instructional practices can support students' "access to mathematical content and discourse practices" (Esmonde, 2009, p. 250 in Herbel-Eisenmann et al., 2013 p. 182). They describe *powerful* as the ways in which the teacher's discourse practices support students' "(positional) identities as knowers and doers of mathematics" (Esmonde, 2009, p. 250 in Herbel-Eisenmann et al., 2013 p. 182). The materials introduce six Teacher Discourse Moves (TDMs) as tools for teachers to develop their discourse practices. Table 3.1 includes the name of each of these TDMs and a brief example of what a teacher might say or do for each move.

Table 3.1:

Teacher Discourse Moves and Examples

Teacher Discourse Moves (TDMs)	Examples
Waiting	A teacher pauses for several seconds after asking a question.
Inviting Student Participation	"Would anyone like to share their thinking on this problem?"
Revoicing	"So what I hear you saying is that you couldn't use the quadratic formula because the equation is not set equal to zero. Is that right?"
Asking Students to Revoice	"Can somebody take what was just said and put it into their own words?"
Probing a Students' Thinking	"Can you say a little bit more about how the table of values relates to your graph?"
Creating Opportunities to Engage with Another's Reasoning	"What questions do you have about the proof that was just shared by the last group?"

The MDISC facilitated PD began by establishing the role of discourse in secondary mathematics classrooms, including sharing research-based ideas that when teachers

establish norms for classroom discourse that reveal students' mathematical understandings, they are well-positioned to build students' deep understanding of mathematics (e.g., Cobb, Boufi, McClain, & Whitenack, 1997; Hufferd-Ackles, Fuson, & Sherin, 2004). The TDMs were then introduced as tools for teachers to open the discourse in their classrooms, as the PD progressed the use of these tools were developed including exploring productive and powerful discourse in relation to interacting with students in both small group and whole group settings.

During the first year of cycles of action research (2013-2014), the participants focused on building a deeper understanding of what they valued in students' written explanations of mathematics problems. They also spent time examining and designing tasks to support opening the discourse in their classrooms and allowing opportunities for a range of students to be involved in talking and writing about mathematics. As a result of this first year of collect action research, the participants worked with Dr. Trainer at the district level to begin piloting a different mathematics curriculum that would provide more support for the kinds of tasks they believed were most helpful to their students.

During the year of this study (2014-2015) participants generated their own individual action research plans. They started by generating topics that they found most interesting from their work during the previous two years with the MDISC PD. Table 3.2 includes a brief description of the research focus for each participant along with their plans for data collection.

Table 3.2:

Action Research Plans

	Research Question	Hypothesis	Data Sources Primary	Data Sources Secondary
Mr. Hale	How does connecting multiple representations (i.e., pictures, symbols, words) through the tasks I use and more purposeful use of the *Creating* and *Asking* students to revoice moves affect students' understanding of mathematics?	Connecting multiple representations through tasks and the *Creating* and *Asking* students to revoice moves will affect student understanding	Student written work	Video recording of classroom discussions
Ms. Pell	When I give opportunities for students to explain and justify their thinking in writing, how does that support students to express their understandings of the math learning goal(s)? How do the *Creating* and *Probing* moves support students to express their understandings of the math learning goal(s)?	If you engage in the kinds of conversations that allow students to be explicit about their thinking, then it can support them to express their understanding about the math learning goal(s).	Student written work	Teacher journal
Ms. Barton	How does being more purposeful in my use of *Inviting*, *Asking* students to revoice & *Creating* moves affect how productive and powerful student-to-student interactions are in whole group discussions?	If I am more purposeful in my use of the *Inviting*, *Asking* and *Creating* moves then productive and powerful, whole group student-to-student discussions will increase (as much as 90% student-to-student conversations)	Video recordings of whole group discussions	Student writing about weekly participation
Ms. Jackson	When I am purposeful about using the moves *Waiting*, *Probing*, *Asking* students to revoice how does it affect students productive and powerful participation in whole group discussions?	Being more purposeful about using the moves *Waiting*, *Probing*, *Asking* students to revoice will increase students productive and powerful participation in whole group discussions, including involving more students in discussions.	Video recordings of whole group discussion; Tracking which students participate	Exit tickets about students' participation

These action research plans are not the primary focus of this research, but they shaped the

ways participants selected and discussed data in the context of their action research work.

Although each participant selected a unique research focus (e.g., multiple representations,

written explanations, student-to-student interactions, student participation), all four plans

included a connection to teachers' use of particular TDMs to shape their classroom practice. Since grant funding tied to the MDISC PD work supported the action research study group, participants were instructed to select research foci that tied to their continued work to develop the ideas established in earlier years of the MDISC PD.

Researcher Positionality

I bring to this research primarily an insider stance (Foote & Bartell, 2011; hooks, 1984). One important similarity I shared with my participants is that I previously taught secondary mathematics in a public school setting. During my tenure as a classroom mathematics teacher I was challenged to provide instruction for students and to assess student understanding, while also being subject to outside pressures from policies, parents, and administrators. Additionally, as a White, middle-class, female I shared many cultural perspectives with my participants.

At the time of this study I had been working with the participants I was studying for two years. As a part of that work, I developed relationships with the participants in a professional development study group setting, interviews, and classroom observations. I believe that the teaching experiences I had in common with my participants helped us to forge a connection that included open communication and honesty. Additionally, participants came to see me as an advocate for teachers, rather than an evaluator. As a result of the openness in our interaction, I felt the need to be particularly attentive to issues of anonymity in presenting my results.

Awareness of my positionality played out in different ways throughout this research. For example, during interviews, I was able to bring up observations from previous years that a participant might not have mentioned or to help clarify a point a

participant made. My insider status also allowed me to place participants' narratives in context in ways that might not have been available to someone who was an outsider. Since I am a mathematics teacher educator and I believe that practicing teachers' perspectives should play an important part in educational research and policy, I needed to reflect on this positionality as I analyzed my data. I made concerted efforts to allow participants' voices to stand on their own through quotations and transcripts and to make explicit my own interpretations. To provide balance to the ways my positionality shaped my interpretation of data I shared material with participants that had been written as a part of the research process.

Data Collection

This study focused on the third year (AY2014-2015) of collaboration with mathematics teachers at Jefferson Middle School. Data sources included: (a) interviews with the participants, district and building administrators, and data and mathematics support personnel; and (b) video recordings and field notes for all action research study group sessions. In the sections that follow, I describe these data sources in more detail and explain my analyses. The Data Use Matrix, Table 3.3, provides an overview of data sources and corresponding analyses organized by research question.

Table 3.3:

Data Use Matrix

Research Question	Data Sources	Data Analysis

RQ 1: *What* data do teachers notice or identify as valid evidence?	• Interviews
	  ○ 3 semi-structured with participants across school year
	  ○ 1-2 semi-structured with: building principal, district administrator, math coach, data coach
	• Study group sessions
	  ○ About one/ month for two hours (~ 26 hrs.)
		• Interview transcription
		• Selection of study group segments
		• Content analyses: Examination of types of data and ways they were used
		• Theme generation
		• Triangulation via constant comparisons and searching for discrepant events across data sources and across time.

RQ 2: *How* do teachers discuss data and evidence? RQ 4: In what ways do issues of *agency* surface as teachers discuss data and evidence over time?		• Narrative identification and transcription • Narrative discourse analysis: focused on how participants described data, use of indexicals and descriptors, and narrator positioning • Theme generation • Triangulation via constant comparisons and searching for discrepant events across data sources and across time.
RQ 3: What *policies and initiatives* influence teachers' understandings of data?	• Interviews • State legal statutes • Evaluation tools • Policy and initiative documentation including correspondence and press releases	• Documentation identification • Coded using themes generated from prior analyses • Focus on content: types of data and suggestions for use.

Interviews. The first primary data source for this study included individual

interviews with the four participants, Ms. Barton, Ms. Jackson, Mr. Hale, and Ms. Pell. I

interviewed these mathematics teachers in person and by phone three times across the

beginning, middle, and end of the school year. I conducted additional interviews with the

building principal, Principal Martin (twice), the district director of education and

curriculum, Dr. Trainer (once), the building data coach, Ms. Fisher, (once) and the

mathematics coach/interventionist, Ms. West (three times). I interviewed Ms. West at the

same time points as the four central participants. She was an active member of the action

research study group, taught a math intervention course, and worked as a math coach in the participants' classrooms.

All interviews were digitally recorded. For each interview I used a semi-structured interview protocol I developed based on Coburn and Turner's (2011) framework (Appendix A). I modified the protocol slightly after the first interview to accommodate what I had already learned from participants and to better match the ideas that were being discussed during the action research study group sessions. I designed the protocol to provide interviewees opportunities to express their ideas about what data they saw as valid evidence and to discuss their thoughts about data and evidence more broadly. The protocol was adapted for administrators to included modified questions and probes so I could gain insight into district-level perspectives and policies impacting teachers' data use.

Study group sessions. The second primary data source included video recordings for all 12 action research study group sessions. Standard sessions occurred once each month for about two hours across the school year. Additionally, there were two longer "data dive" sessions that lasted about four hours and included both discussion time as well as time for participants to individually examine data they had been collecting. Overall, these sessions comprised about 28 hours of contact time.

Each session included many opportunities for participants to discuss their research efforts and to present and compare their data. At times, the university facilitator directly prompted participants to make claims about what they were seeing or to share specific data. At other times participants discussed issues of collecting, interpreting and making use of data unprompted. Conversation flowed free form and participants regularly critiqued and supported one another's contributions to the group. In addition to the recordings, I

attended (in-person and virtually) nearly all sessions, and took field-notes focused on participants' discussions of using data and the questions they asked.

Data Analysis

To address the first research question focused on *what* data teachers used, I began by closely listening to all my recordings, focusing on the types of data participants discussed. I transcribed all interviews attending to pauses in speech and hesitations (e.g., um, ah) and any pauses that lasted two seconds or longer were indicated on the transcripts. Additionally, I selected and transcribed portions of the action research study group sessions in which participants discussed the data they noticed and their related reasoning for particular uses of data. In order to make decisions about which study group segments to transcribe and focus further analysis, I re-watched all study group sessions while reading along with my fieldnotes. I noted any instances where teachers discussed data or evidence. This included any explicit references to the terms *data* and *evidence*, as well as discussion about assessments, classroom discussions, informal observations, etc., upon which participants based claims about their students or their instruction.

To illuminate my selection process I present two examples here. First, from the first study group meeting in August, I identified 38 minutes of conversation during which the group explicitly discussed Ms. Barton's and Mr. Hale's research foci and the data sources they might use for the action research work. Additionally, I also identified about 8 minutes of conversation from the same study group session, during which the group talked about wanting to observe one another's classrooms and the logistical challenges they had encountered trying to video recording their own teaching.

The first 38-minute segment included many explicit statements from participants about particular data sources and what they might learn from those data. In contrast, the second 8-minute segment included participants talking about ways that they could learn more about their own instruction. Throughout my analysis, I focused on discussions that included both explicit and implicit references to data and evidence that participants used. Overall, I identified about 282 minutes, or 33% of the total meeting time, of the action research study group sessions that included discussion focused on using data and evidence. Of that, I transcribed about 100 minutes for detailed analysis.

After the transcription process, I analyzed all interview and study group data using methods of conventional content analysis (Hsieh & Shannon, 2005). Specifically, I looked for any mention data and its uses in all data sources, and then, I generated categories inductively from the data. I organized salient information from the interviews and selected study group segments into a spreadsheet with rows for each interview and study group session and columns for topics that I generated via my content analysis (e.g., meaning of the term data, types of data used in regular teaching to track student progress). Subsequently, I refined my initial codes as I looked for similarities and differences in participants' descriptions. I paid particular attention to the contexts in which participants described using data and the audience with whom they were working.

To address the second research question, focused on *how* teachers discussed data and evidence and the forth research question examining teachers' expressions of *agency*, I utilized narrative discourse analysis techniques. Although I did not conduct a comprehensive narrative analysis, I employed techniques used by narrative discourse scholars (e.g., Gorgakopoulou, 2007; Labov, 1972; Reissman, 2000; Wortham, 2001). I

found that narrative techniques offered a useful lens to examine teachers' expressions of agency (or not) as it related to their interactions within various contexts because individuals can use narratives to share organized presentations of events interpreted through their own personal, social, cultural, and emotional lenses. In particular, narrators can present themselves as having agency in particular situations, such as purposefully initiating action, or as having less agency by assuming passive roles in other situations. Reissman (2000) described narrators as *performing* such roles through the grammatical resources they employ (e.g., verbs, elaboration, repetition, emphasis).

To conduct my analysis, I first spent considerable time identifying narrative segments of speech related to data. Initially, I struggled to define what I would count as a narrative because the narratives participants' shared were typically quite brief and did not have many of the typical markers of entrance and exit talk, such as "For example I once…" (Labov, 1972). After reading through my complete data set many times looking for narratives, and consulting narrative discourse literature, I established my own criteria for narratives as they pertained to this study. Specifically, I considered narrative segments as instances in which: (a) one speaker held at least two consecutive turns or an extended turn (10 or more lines) on the same topic and (b) turns included at least one *temporal junction* – meaning the segment had at least two clauses that if their order were reversed it would change the listener's interpretation of the described events (Labov, 1997). Since interviews were conducted with only one participant at a time, the second criterion was particularly important for interview data.

For example, Example 3.1, below, is an excerpt from my first interview with Mr. Hale that fit my criteria for narratives related to data use for this study. Mr. Hale responded to

41

my question about what information he would provide to an administrator who asked him

to provide evidence of student learning. I also asked how what he shared might be similar

or different if he were talking to another teacher.

Example 3.1:

1	Mr. Hale:	Um. I'd look a lot less as the standardized data.
2	Cavanna:	MmHmm.
3	Mr. Hale:	We still look at the common assessments, but it would be more
4		practice-based. Which problem really caused some issues? You know,
5		more of a strand analysis kind of thing. But, you know, at what point does
6		the district administration care about that or follow up on it? They don't.
7		So, they ask us to do things, but it's so generic it doesn't help. So when I sit
8		down with [Ms. Pell] or with [Ms. Barton] or whatever, we're going to say –
9		If we're talking to [Ms. Barton], are these the types of things that are
10		going to prepare them [seventh grade students] for your course [eighth
11		grade math]? Are we missing things? Is this [instruction] appropriate?
12		Does this [instruction] help? Or whatever. And [Ms. Pell] and I are going
13		to look at it and say, "Oh my God! Every kid missed number six, what are
14		we going to do about this? Um. Making sure that they're – it's actually
15		indicative of something they've [students] learned. And that they've got
16		opportunities to access it and that it's not just fact-based. And all of the
17		discourse stuff is coming up in those assessments, too. You know. I mean,
18		you look at stuff I wrote ten years ago, and it's like, "Let's solve these" [flat,
19		uninterested tone] And now they're writing on every single one [problem].
20		And now we're drawing pictures on all of these as well. And now we're
21		saying, "Well, how can we [the class] explain this? And here's an example of
22		some student work. And what do you [a student] have to say about this?
23		Are there any errors? And can you build an explanation on top of that?" So
24		the depth is getting to be a lot more. And so that's what – that's the
25		difference between what we give to the administration and what we talk
26		about amongst ourselves. It's really that depth and purpose. You know
27		we're skimming the surface for what we're giving the district, because
28		that's what they're asking for. And not doing anything with it, as far as we
29		can tell.

This excerpt is characteristic of the kinds of narratives I analyzed. It includes Mr. Hale's

description of how he interacts with his colleagues and with administration around data. In

particular, he described the specific actions he take to interpret information with Ms. Pell and Ms. Barton.

Although examples like Example 3.1 do not include typical narrative structures (e.g., introduction, climax, conclusion), in my analysis, I found it informative to consider participants' extended responses because it enabled me to study the ways they actively shaped their descriptions of interactions with people and with data.

Building from theories that indicate that narratives offer ways for teachers to construct their identities both individually and collectively (e.g., Gorgakopoulou, 2007; Riessman, 1993), I inductively examined this set of narrative excerpts. I looked for the ways participants enacted particular interactional positionings of themselves and the hearers (Wortham, 2001). Wortham (2001) explained, "An utterance comes to position speakers and hearers as it gets recontextualized by subsequent interactions or as a pattern of relevant context emerges over time" (p.41). In order to interpret participants' statements, therefore, I considered not only the specific utterance, but also to subsequent statements made in the same narrative or at a later time in order to help solidify the meaning of the original statement.

As a result, my analysis of the set of narrative excerpts involved many readings and re-readings of the narratives in order to develop a rich understanding of what participants were saying and how they enacted particular positionings at particular times. I closely attended to the ways participants used grammatical resources (e.g., verbs, pronouns, repetition) within and across narratives.

I present Example 3.2 in order to illustrate some of the ways that I analyzed narrative excerpts as means to interpret participants' interactions around data. In Example

3.2, taken from our second interview, Ms. Barton described a particular instance when she

changed her instruction based on data about her students. I discuss this narrative excerpt

in more detail in Chapter 7.

Example 3.2:

1	Cavanna:	Can **you** tell me about a time when **your** instruction has changed
2		as a result of data **you** had about students? And if it hasn't changed,
3		then **you** can tell me about that.
4	Ms. Barton:	Okay. Well, **we** made some decisions based on some things that
5		**we** collected. Um. **They** totally understand this, it doesn't make sense
6		to put another day into it.
7	Cavanna:	Mmm.
8	Ms. Barton:	**We** think that based on **our** discussions about transformation,
9		early on when **we** first visited the families of functions, and based on
10		the data from their assessment on that unit, how now that **we** are
11		specifically looking at exponential functions […] **we're** going to spend
12		very short amount of times on that just going over what **we** did with
13		**our** families of functions and transformations because **we** know **they**
14		really demonstrated some strong understanding of of function
15		families and transformations.
16	Cavanna:	Mmm.
17	Ms. Barton:	So, **we** don't need to spend a lot of more time on that. Just
18		review it as it relates to exponentials, and move on.

I highlighted the pronouns and possessive pronouns to illustrate how these acted as

indexical cues (Wortham, 2001) that help to illuminate the context and meanings behind

Ms. Barton's response. In lines 1-2 I posed my question to Ms. Barton in the singular, using

"you" and "your," asking Ms. Barton to talk about her own instruction. Throughout her

response, however, Ms. Barton used the plural pronoun "we" to describe decisions she and

Ms. Jackson made collaboratively (lines 4, 5, 8, and 13).

To analyze Example 3.2 I first engaged a close reading of the Ms. Barton's statements to examine how she enacted interactional positionings within this particular excerpt, including her use of indexical cues. Then, I considered this example in light of the rest of the set of narrative excerpts, both Ms. Barton's other narratives as well as those of the other participants. By zooming out, I determined that all the participants regularly referred to themselves collectively as a mathematics department and as grade level teams. Taken as a whole, this pattern of interactional positionings helped me to see that participants described data use as a collaborative activity that involved making sense of information and determining next steps together with their fellow teachers.

Using an iterative analysis of the set of narrative excerpts, similar to that described for Example 3.2, I characterized themes based on: (a) how participants described data, (b) narrators' explicit use of indexicals (e.g., I, we, them) and descriptors, and (c) implicit types of positionings that emerged in patterns across data sources and across time. I used a constant comparative method to refine my themes. I searched for discrepant events across data sources and time points as a means to triangulate my findings. I also compared my themes to the *processes of data use* (Coburn & Turner, 2011) identified in the theoretical framework for this study. The ways that I related my themes to the theoretical framework are discussed further in subsequent sections and in Chapter 4.

Additionally, I shared portions of the findings with participants and conducted a member check. In particular, I selected sections of my findings that included my interpretations about the ways participants positioned themselves and express their agency. I decided to share specific portions of the findings that I thought offered participants the most openings to speak back against my interpretations. Since participants

could serve as authorities on their own positioning and interactions, I included those sections.

Throughout my member check conversations with participants, they consistently confirmed my interpretations. In fact, they did not disconfirm any of my interpretations regarding their interactions, positioning, and agency. Instead, multiple participants explained that reading through my findings help them to more clearly see how they interacted differently with other stakeholders than they did with other teachers. One participant went so far as to explain that as a result of reading my findings she planned to intentionally position herself more actively in future interactions with other stakeholders.

To address the third research question, focused on *policies and initiatives*, I focused on a slightly different set of interviews and examined public records. Specifically, I examined interview data from the primary participants along with the building principal, Principal Martin, district director of education, Dr. Trainer, as well as the instructional coach, Ms. West, and the school data coach, Ms. Fisher. Additionally, I consulted teacher evaluation documents presented to teachers along with the legal statutes issued by the state. Since the teacher evaluation policies and DDDM initiatives enacted by the state, district and school informed the data use context for participants, I consider these descriptions an important part of the report of this research.

Analysis for this research question was conducted last. Rather than build inductively from policies, I coded these data using the themes I generated during the previous phases of analysis. Specifically, I examined interviews and documents coding for: (a) noticing data; (b) interactions around data; (c) implications and of data; and (d) timescale for data use. I describe these categories in detail in Chapter 4.

CHAPTER 4: OVERVIEW OF FINDINGS – CONNECTIONS TO THEORY

The findings presented in the following chapters illustrate the kinds of data teachers attended to and the ways they discussed and used those data in different contexts. Specifically, the ways teachers used and discussed data varied in relation to the audiences with which they interacted. I observed consistent themes as teachers used data in relation to the following audiences: (a) other stakeholders (e.g., administrators, parents), (b) teachers (including for their own use), and (c) university researchers and teacher researchers. I illustrate these themes through detailed portraits of what data participants used and the ways they use those data for each type of audience in Chapters 6, 7, and 8.

Additionally, the findings are organized by categories built from the data use processes outlined by Coburn and Turner's (2011) theoretical framework. The framework includes three processes for data use: *noticing*, *interpreting*, and *constructing implications*. I add to this set two categories I observed in the data: (1) interactions around data and (2) the timescale for data use. Figure 4.1 illustrates the ways the categories used here build from Coburn and Turner's framework.
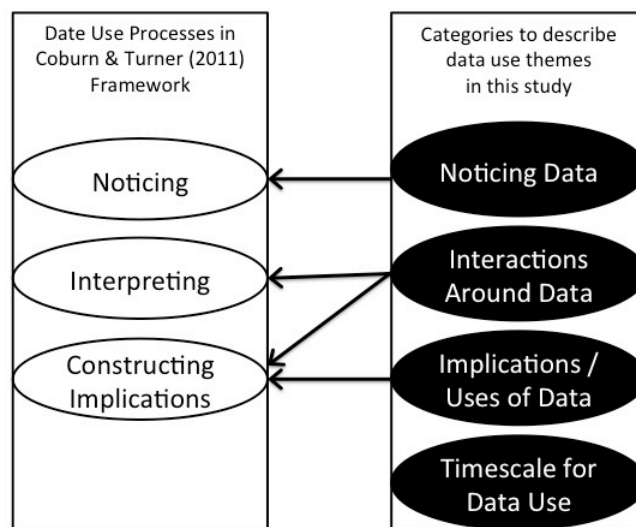
Figure 4.1. Development of Categories from Framework

For each portrait of data use I organize my findings around the categories: (1) noticing

data, (2) interactions around data, (3) implications and uses of data, and (4) timescale for

data use. Through my analyses, I recognized that teachers' work of noticing, interpreting,

and constructing implications for data were intimately tied to teachers' interactions.

Similarly, I observed that interpreting data involved teachers both making sense of what

the data meant to them as well as deciding how that data should be used. Therefore,

instead of using the categories *interpreting* and *constructing implications* as Coburn and

Turner did, I split those processes across two categories: *interactions around data* and

implications and uses of data. Additionally, Coburn and Turner's framework did not take

into consideration the timescale for teachers' data use as I do here. Table 4.1 presents an

overview of the findings of this study organized by audience and data use processes.

Table 4.1:

Overview of Teacher Data Use for Different Audiences

	Audience		
	Other Stakeholders	**Teachers**	**Researchers**
Noticing Data	• Primarily standardized test scores	• Primarily classroom generated data	• What does "data" mean? • Action research plans
Interactions Around Data	• Passive positioning of teachers • Limited interactions around data	• Active positioning of teachers • Collaborative interactions around data	• Collaborations & Support • Active positioning of teachers. • Expressions of agency
Implications & Uses of Data	• Data mostly used to justify prior decisions	• Data used to inform instruction	• Different evidence to support claims, including prior experiences, broader knowledge of students and specific data
Timescale for Data Use	• Retrospective. Across multiple months	• Immediate and ongoing	• Longitudinal; Patterns across time

To further clarify this organizational structure, here I briefly describe the features of the data use process categories and how they align to the theoretical framing of this paper.

Noticing Data

Participants were consistently exposed to streams of data about students. Teachers had access to information about student histories, including demographic data, information about special education services and major behavioral interventions. Teachers also had access to a wealth of assessment data including a full complement of scores on state standardized tests, standardized benchmark tests and subject-specific common assessments. Additionally, teachers had access to data generated through their interactions with the 100 or more students they taught daily. Perhaps surprisingly, given the large amounts of available information, participants did not succumb to data-overload as some literature has described. That is, teachers did not stop utilizing data as a result of having too much of it in inaccessible forms or spending too much time trying to locate it. Instead, selectively attended to particular types of data at particular times in order to make decisions about what their students understood and what their next instructional steps should be. For each portrait of data use, I describe the types of data to which participants attended and the circumstances surrounding these decisions in the category *Noticing Data*.

Interactions Around Data

Any efforts teachers make to interpret and use data occur within the context of a myriad of overlapping factors. Coburn and Turner's framework highlights the intertwined nature of the processes of data use through interconnected regions. The findings presented here highlight the range of participants' interactions around data. These interactions were

influenced by outside contexts and the interactions themselves also shaped data use practices. Considerations of teachers' agency are absent in the original theoretical framework. Using an ecological understanding of agency supported me to consider the ways in which teachers expressed control and active participation in particular circumstances as compared to less control or passive engagement in others. The character of interactions between participants, other teachers and administrators were captured through narratives participants told and the ways they told those narratives. Specifically, I drew on narrative discourse analysis to illuminate how teachers positioned themselves in relation to their audience. For each portrait of data use, I describe participants' expressions of agency and the characteristics of their interactions with different audiences in the category *Interactions Around Data*.

Implications and Uses of Data

Participants interpreted many different forms of data and made use of those data in a variety of ways. The final process of data use that Coburn and Turner's framework outlined is *constructing implications* – determining what data actually mean for instruction and/or for students. I observed participants to be action oriented and their efforts to construct implications were closely linked to the ways they used data in practice. These findings illuminate participants' interpretation of the meaning of data and the ways participants made use of those data to: (a) justify decisions, (b) inform instruction, and (c) make and support research claims. For each portrait of data use, I describe participants constructing implications and using data for particular purposes in the category *Implications and Uses of Data*.

Timescale for data use

Since teachers are consistently exposed to data, part of the work of noticing data also involved decisions of *when* particular data are important. These findings indicate that decisions about the timescale for when to use particular data varied in relation to how participants used that data and who their audience was. For each portrait of data use, I describe the nature of the timescale of how participants attended to and used data in the category *Timescale for Data Use.*

In Chapter 5, I discuss findings related to the DDDM initiatives and teacher evaluation policies that shaped the data use contexts for participants. Then, in subsequent chapters, I characterize participants' data use for each category illustrated by Table 4.1.

CHAPTER 5: EXPLORING DATA-DRIVEN DECISION-MAKING INITIATIVES AND

TEACHER EVALUATION POLICIES AND THE MEANING OF DATA

Using the Coburn & Turner (2011) framework as a guide, I recognized that in order to understand the processes of data use enacted by participants, I first needed a sense of the organizational and political contexts in which participants worked. In response to the research question: *What policies and initiatives influence teachers' understanding of data?* I explored the systems and policies in place at the time of the study that had the potential to shape participants' data use. Specifically, this chapter reports my findings related to (a) DDDM initiatives, (b) teacher evaluation policies, and (c) administrators' interpretations at the state, district, and school levels. Broadly, I found that teacher evaluation policies and DDDM initiatives at the state, district, and school levels influenced how data were implicitly defined and thereby shaped the expectations for teacher data use.

In the following sections, I first describe the DDDM initiatives and then the teacher evaluation policies at each of the state, district, and school levels that shaped the context for data use for teachers at Jefferson Middle School. I include interpretations of the ways the policies and initiatives may have influenced what it mean to use data for participants in the mathematics department of Jefferson Middle School. I also describe the ways administrators at the district and school level described the term *data* and I discuss the ways those interpretations may have also shaped participants' interactions with data. Figure 5.1 summarizes the initiatives and policies I identified at each level.
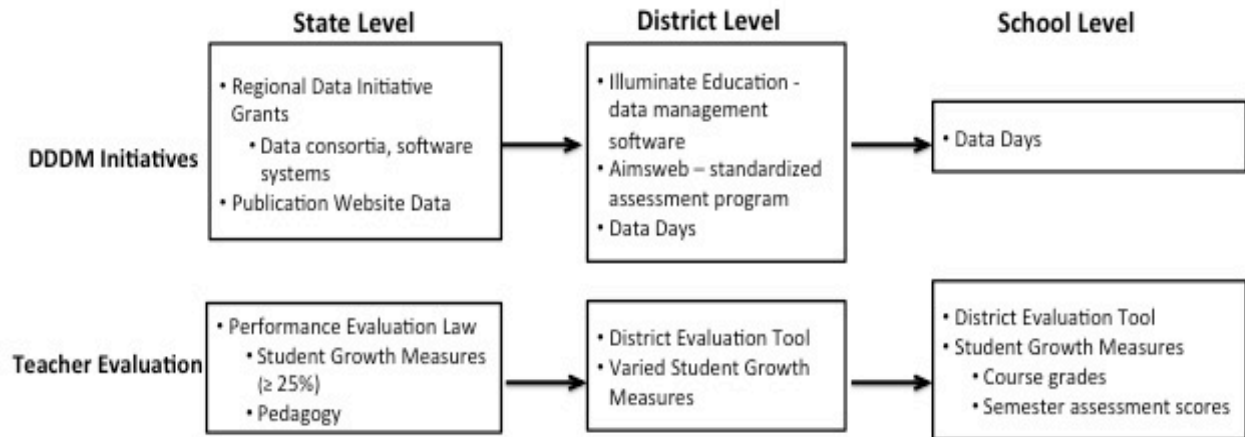
Figure 5.1. Summary of DDDM Initiatives and Teacher Evaluation Policies

State-Level DDDM Initiatives

Beginning in 2009 and continuing through 2012, the state department of education
operated a program, Regional Data Initiative Grants (RDIG), to promote data use in schools.
The RDIG program was funded through the U.S. Department of Education as a part of the
American Recovery and Reinvestment Act of 2009, (CFDA number 84.386). One of the
outcomes of the RDIG program was that it prompted multiple intermediate school districts
(ISDs) to establish consortiums around data. The ISD for the Greenville School District
became part of the "Pearson Inform consortium." All ISDs in the Pearson Inform
consortium used Pearson Corporation[2] products as a part of their data management tools
and the ISDs collaborated to provide training and support for teachers, administrators and
parents around the use of those products. Training and support focused on use of the
Pearson Inform software and including "quick start" guides and resources (e.g., Felky,
Flukes, & Berry, 2010).

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[2] Considering issues of power and influence at play, it is important to note that at the time
of this study, the state treasury owned a significant share of stock in Pearson, Plc. In fact,
the state treasury owned the sixth greatest number of shares in the company valued at
over 13 million dollars (Nasdaq, 2016).

Following the RDIG program, the state department launched an initiative to make data publicly available on the web. This included all state-level public education data for preschools through postsecondary (P-20). This 2011 initiative centered on a website portal designed to make educational data sets readily available to anyone, including parents as well as researchers. The data included assessment results for all state mandated testing, student population counts, attendance and/or graduation rates, and ACT test results by school, among others. Additionally, this data initiative included the development and dissemination of performance metrics such as Annual Education Reports and School Accountability Scorecards. These reports were developed in response to federal requirements from No Child Left Behind (NCLB) to report on schools' annual yearly progress (AYP). Annual Education Reports and School Accountability Scorecards reported detailed information on teacher quality, student assessment, and other accountability factors for schools and districts and offered ranking criteria to make schools and districts more comparable to one another.

By the nature of its design, the website published data with school names attached, but decontextualized from school settings. Specifically, data about students, teachers, and schools were quantified and represented in charts and graphs with no additional text to describe more complex qualities beyond the numbers. Similarly, the website initiative provided no guidance or framing for the interpretation of school performance metrics (e.g., school rankings). Without additional information about school context or the meaning of data, the numbers were left to speak for themselves (see Goldstein & Meyers, 1996 for considerations regarding the release of school data). For example, Figure 5.2 is a sample taken from the website for the Greenville School District.

Teacher Effectiveness (2014-15)

%

Highly Effective

Effective or More (Highly Effective or Effective)

Minimally Effective or Less (Minimally Effective or Ineffective)
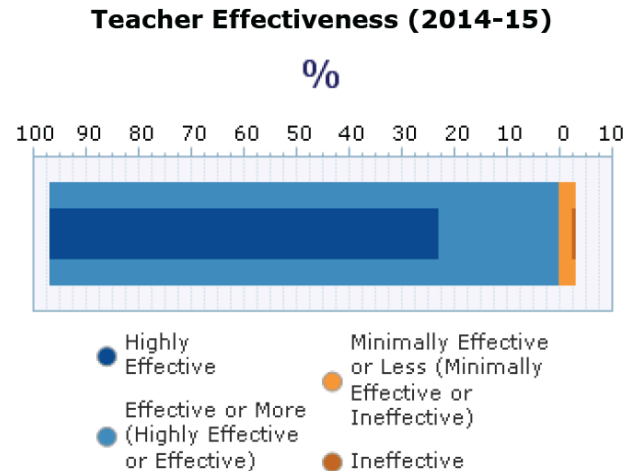
Ineffective

Figure 5.2. Teacher Effectiveness Example from State Data Website

There is no accompanying text to support or inform interpretations of the graph in Figure 5.2. As an informed viewer, I can see that the graph suggests that nearly 100 percent of the teachers in the Greenville School District were rated as at least *effective* and about 75 percent of the teachers in the district were rated *highly effective*. Any interpretation about what these percentages might mean for students or how they reflect on the district is left to the viewer to determine. Additionally, there is no information about the ways teachers are evaluated; and, as is discussed in sections below, those evaluations significantly varied between schools and districts.

These state initiatives shaped the data use context for teachers by establishing precedents for the ways data and data use were defined. Particularly, the funding and training for data warehouse and management software (e.g., Pearson Inform) prioritized data that could be entered, tracked, and reported by such systems. Although such software may allow for some qualitative data entry (e.g., behavior tracking), data warehouse and management software are particularly powerful tools for managing quantitative data. In fact, after these software programs were in place, state standardized test data were

automatically imported into the system and made immediately available to educational stakeholders. This kind of automation mitigated the challenges of data entry (e.g., Mason, 2002; Secada, 2001). With test scores so easily and readily imported, however, the data initiatives that established expectations for data warehouse and management software prioritized standardized test scores as essential data, integral to the systems. As a result, the definition of *data* at the state level implicitly focused on numerical scores, easily entered and manipulated by data warehouse and management software systems.

State-Level Teacher Evaluation Policies

The state legislature enacted a law that established criteria for mandated performance evaluations for all teachers in public schools throughout the state (Section 380.1249 of the Revised School Code Act 451, 2011). This law required that teacher evaluations be used to inform decisions regarding: (a) teacher effectiveness, (b) promotion, retention, and support opportunities, and (c) issuance or revocation or tenure. Additionally, the state law specified that a "significant" portion of the evaluation be based on "student growth", which should be measured using both state assessments and "rigorous alternative assessments." Initially, student growth measures were mandated to comprise 25% of teachers' evaluations. The law indicated this percentage should increase each year until 50% of all teacher evaluations were based on student growth measures. As of AY2014-2015, the percentage increase had not yet been implemented and student growth measures remained 25% of teacher evaluations.

Importantly, however, this law left a number of components of teacher evaluation open to the interpretation of local districts and schools. First, the details of what specifically comprised student growth measures were left to the determination of local

districts and individual schools. Consequently, the ways student growth was measured could vary significantly between schools even within the same district. I discuss this issue further in relation to the teacher evaluation policies in place in the Greenville School District.

Second, the law provided only limited recommendations regarding the portion of teacher evaluations not tied to student growth. It specified that the portion of a teacher's evaluation not measured using student growth data would be based on a teacher's performance as measured by an evaluation tool developed or adopted by the school district. In particular, five evaluation tools were recommended for districts to use (MCEE, 2013). A statewide evaluation tool was supposed to have been created or adopted, however, due to legislative disagreements regarding what that tool should be, it did not yet exist at the conclusion of this study.

District-Level DDDM Initiatives

The DDDM initiatives at the Greenville School District followed in the path established by the state-level DDDM initiatives. In particular, the district and ISD focused on data management software, standardized assessments, and related training for teachers. Significant funding was invested into computer software systems designed to support teachers and administrators to gather, organize, and use data about students. Specifically, the ISD supported two software programs that shaped how data were defined by the district: (a) *Aimsweb,* a standardized formative assessment program, and (b) *Illuminate Education*, data warehouse and management software. Additionally, the district mandated use of these systems through requiring teachers to participate in district data days.

Aimsweb Assessments. Aimsweb was a commercial package of assessment tools marketed by Pearson Corporation. The Aimsweb website described their services as "general outcome measurement, a form of curriculum-based measurement (CBM), used for universal screening and progress monitoring," which includes brief, web-based, standardized assessments to test basic skills at each grade level (http://www.aimsweb.com). As it was utilized at the Greenville School District, the Aimsweb program included "progress monitoring" or small assessments given to all students three times each year in order to track students' progress in mathematics and literacy. Additional assessments were administered for students who were struggling in order to help determine when to begin and end math or literacy intervention services.

The Aimsweb mathematics assessments or "screeners," as they were called by participants, comprised brief (about 10 questions), timed tests that focused on basic skills including mathematical computation (M-COMP) or applications (M-CAP). For example, on the M-COMP assessments students were expected to generate numeric responses to basic addition, subtraction, multiplication or division problems. Participants indicated that the tasks on the M-CAP assessment did not involve much more application or high-level thinking skills than the computation assessments. Therefore, they rarely used the M-CAP application assessments.

These screeners were not specifically linked to the Common Core State Standards for Mathematics (CCSS-M; NGA & CCSSO, 2010), nor were they specifically aligned with the curriculum used at the Greenville School District. Participants described using student scores on Aimsweb assessments to inform decisions on: (a) class placement (e.g., algebra or eighth grade math), (b) determining whether or not students required intervention

services for gaps in their mathematics concepts or skills beyond what participants could

provide in their classrooms, (c) tracking student progress in intervention classes, and (d)

determining when students were ready to conclude intervention services.

Aimsweb assessments were standardized (i.e., nationally normed) and thus

provided opportunities to compare classmates' scores to one another as well as to compare

scores for Greenville district students to student scores across the country. All student

scores for district-wide administrations of Aimsweb screeners were automatically

imported into the data warehouse and management systems (three times annually). As a

result, the Aimsweb data formed part of the core data available to teachers through the

data software systems. Interestingly, Aimsweb screeners were not used as a part of the

student growth measures at Jefferson Middle School or at the district high school. Aimsweb

screeners were used as student growth measures, however, at the elementary level. I

discuss this use, and non-use, in more detail in the section about school-level teacher

evaluation below.

Illuminate Education Data Management Warehouse. The software, *Illuminate*

Education (referred to by participants as "Illuminate Ed"), was described as a

"comprehensive, web-based data and assessment management warehouse"

(http://www.illuminateed.com). Its structure and capabilities were similar to those of the

Pearson Inform software adopted via state initiatives a few years earlier. Thus, the ways

state-level data initiatives may have shaped the data use context also applied at the district

level. As it was used in the Greenville School District, the Illuminate Ed software stored and

organized information about students including, report card grades, semester assessment

scores, state standardized assessment scores, and Aimsweb scores, across students'

academic careers. Most often, data were entered into the Illuminate Ed system either automatically (e.g., state standardized assessments, Aimsweb scores) or by personnel at the ISD level, not by teachers or administrators at the school level.

The primary interaction between Greenville district users and the Illuminate Ed software was through the creation of data "reports." Any teacher, administrator, data coach or ISD staff member with access could use the Illuminate Ed software to generate a report of particular data. These reports contained numeric summaries (i.e., descriptive statistics) or graphical representations of data based on parameters specified by the user.

District-level Data Days. The district and ISD levels required teachers to use data in these software programs by mandating participation in district "data days." These days were classified as required professional development time and scheduled into the academic calendar. Teachers worked individually or in teams with data coaches to access the Illuminate Ed database and to generate various Illuminate Ed reports. Data days also involved teachers examining Illuminate Ed reports created by other users, such as data coaches or administrators.

In order to create a data report one would need to use many of the data use processes identified by Coburn and Turner 's (2011) framework. For example, deciding which data to include on the report would require *noticing data.* And determining how best to display and summarize particular data would require *interpreting data.* Since the reports included only formatted data and graphs retrieved from the database, however, any further analysis or *constructing implications* of the data would occur after the report was created.

In instances when pre-made reports were presented to teachers, the report creators took over many of the data use activities, including expressing agency by manipulating data

for particular purposes. As a result, when teachers were presented with completed reports, teachers were distanced from many components of the data use process. Even though teachers were initially involved in the production of the data on the report (e.g., they administered assessments to students), they described being less connected to that information when handed a report. Consequently, the ways teachers interacted with pre-made reports further influenced implicit definitions of data at the district level. Specifically, previously created data reports positioned data as pre-existing information that was outside the control or influence of teachers.

District-Level Teacher Evaluation Policies

Since the state laws around teacher evaluation left the majority of the practical details of how teachers should be evaluated up to individual districts and schools, the district played an important role in defining local teacher evaluation policies. State expectations for districts related to the 2011 teacher evaluation law changed numerous times in the years following its enactment. This caused the Greenville district administrators and teachers to struggle with many questions regarding how teachers should be evaluated and what data ought to guide those evaluations. During AY2014-2015, teacher evaluations in the Greenville School District consisted of two components: (a) general pedagogical practices and (b) student growth measures.

Table 5.1:

District Teacher Evaluation Tool—Criteria for Effectiveness

Domain 1: Planning and Preparation for Learning (15%)	Domain 2: Classroom Management (11.3%)	Domain 3: Delivery of Instruction (18.8%)	Domain 4: Monitoring, Assessment, and Follow-Up (15%)	Domain 5: Family and Community Outreach (7.5%)	Domain 6: Professional Responsibilities (7.5%)
• Knowledge • Unit/Lesson Alignment • Engagement • Materials • Differentiation • Environment • Technology	• Expectations • Relationships • Respect • Social-emotional • Routines • Responsibility • Repertoire	• Expectations • Goals • Connections • Clarity • Engagement • Differentiation • Application • Technology	• Criteria • Diagnosis • On-The-Spot • Self-Assessment • Analysis & Reflection • Tenacity • Support • Technology	• Respect • Expectations • Communication • Involving • Responsiveness • Reporting • Resources • Technology	• Professionalism • Reliability • Judgment • Collaboration • Contribution • Communication • Self-Improvement • Technology • Ethics

District-Level General Pedagogical Practices. The greatest proportion of evaluation scores for teachers in the Greenville School District were related to general pedagogical practices. Recall that the state law required 25% of evaluations to be student growth measures. In the Greenville School District, the remaining 75% was allocated to general pedagogical practices. The Greenville School District utilized an evaluation tool heavily based on the *Framework for Teaching Instrument* (Danielson, 2011), which included a set of rubrics targeting pedagogical practices across six different domains. These domains included: (1) planning and preparation for learning; (2) classroom management; (3) delivery of instruction; (4) monitoring, assessment, and follow-up; (5) communication and outreach; and (6) professional responsibilities. Table 5.1 below shows the breakdown of the rubrics within each domain and the percentage of the overall evaluation of each. Across the domains in the Greenville framework, teachers were held accountable for a total of 47 subcomponents. This rubric was used in conjunction with observations conducted by building administrators to determine teachers' performance levels. Then, the outcomes on

the teacher evaluation tool were compiled to account for about 75%[3] of the total evaluation

of each teacher, and student growth measures comprised the rest of the score. Teachers

were rated across the domains as being "Highly Effective, Effective, Minimally Effective, or

Ineffective."

My analysis of the Greenville District teacher evaluation tool revealed that *Domain*

4: Monitoring, assessment, and follow-up included the majority of expectations for teacher

data use covered by this tool. Specifically, Domain 4 included expectations for what data

teachers should attend to (noticing data), teachers working together with colleagues

(interactions around data), and what actions teachers should take based on data

(implications and uses of data). For example, under the category "Diagnosis," teachers were

evaluated on whether they gave students "well-constructed diagnostic/formative"

assessments and "effective methods to check for understanding" and if they used that

information to "fine-tune instruction." Similarly, under the category "Analysis & Reflection,"

teachers were evaluated on whether or not they worked "with colleagues to analyze

assessment data, draw conclusions, and share them with others."

Throughout the evaluation tool, colorful, but unclear language was used to describe

the evaluation criteria and no explicit definitions were provided. The language in the

evaluation tool does not appear as part of the Danielson Framework (2011) on which the

tool was based, so it is unlikely that additional supporting materials were available. For

example, the characteristics for a "well-constructed diagnostic/formative assessment"

were not provided. Likewise, there were no additional factors to define what it might mean

for a highly effective teacher to "*relentlessly* follow up with struggling students with

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[3] The sum of the percentages listed on the evaluation document provided to teachers was 100.1%, so the percentages listed here are slightly off from 75%.

appropriate interventions to achieve proficiency" as compared to an effective teacher who merely "takes responsibility for students are not succeeding and gives them extra help." The lack of explicit definitions for data and data use on the teacher evaluation tool fit with the patterns I observed more broadly at the state and district levels. Teachers had to rely on implicit definitions of data in order to interpret what was expected of them.

  District-Level Student Growth Measures. The 25% of teacher evaluations not specified by the teacher evaluation tool as pedagogical practices were attributed to student growth measures. Since the state law did not specifically indicate what data ought to measure student growth, individual schools made their own determinations. Within the Greenville School District, these determinations varied significantly at each school level. At the elementary school level, student growth measures were defined as Aimsweb test score data. At Greenville High School, student growth was measured using a combination of pre- and post-tests in a few classes and common assessments across each subject. At Jefferson Middle School, student growth measures were defined as teacher-assigned course grades and students' scores for semester exam in each course.

  To get a perspective on how the Greenville School District was interpreting the state policies, I spoke with Dr. Trainer. As director of education for Greenville School District, Dr. Trainer's many duties included overseeing all assessment and curriculum decisions across the district. Describing the ways schools in her district were utilizing data to measure student growth, Dr. Trainer lamented that in districts across the state, "everyone pretty much, almost universally is doing this inappropriately, using inappropriate data to measure student growth – that is not intended to do so."

Dr. Trainer explained she believed many of the issues around what she saw as a misuse of data stemmed from confusion and instability around state and district teacher evaluation requirements. Exactly what schools and districts were being held accountable for regarding teacher evaluation changed multiple times after the 2011 law was enacted. These changes resulted in part from the state piloting of evaluation instruments and from an inconsistent roll out of requirements. In order to comply with the law mandating teacher evaluations, districts and schools had to develop their own evaluation tools based on the limited recommendations and changing expectations. This led to confusion for administrators and significant variation in the character and quality of the evaluation systems across the state (e.g., French, 2013).

Although Dr. Trainer and other district administrators recognized the flaws in their system, they also acknowledged that they were not willing to make dramatic changes while policies at the state level were still in flux. Dr. Trainer explained how the Greenville School District had been struggling to cope with changing state policies:

> It's been, it's really been a challenge. It's a moving target constantly and you can't plan. [...] We have not been able to plan around data at all because of the state keeps changing everything. The laws are in place, but everything keeps changing. The tools, growth measures, teacher evaluations... we have not been able to plan anything, we have just been able to get by. That's what I would say the districts here have been doing. We've just been getting by.

Without clear expectations from the state regarding how teachers should be held accountable, the Greenville School District tried their best to institute a system and stick to it. This system was used for the district just to "get by," even though it lacked some of the

rigor (e.g., using data that better captured student growth) that Dr. Trainer would have liked to have in place.

When I asked Dr. Trainer to explicitly define what *data* meant to her she provided a detailed explanation of the term and presented a clear vision for how teachers and administrators in her district might use data to inform instruction. Specifically, she described data in the following way:

Data is not just numbers and it's just not taking a test and then using that data or those numbers. Um. The data needs to be, um, of quality. It needs to have some depth to it. It needs to be, either created by the teaching staff or the, um, the district itself via committee. So that it is our data and we own the data. Then, that creation in and of itself is incredible valuable professional development. So, when I'm thinking of data I'm thinking of starting from - I utilize the backwards design. So, I'm looking at, okay, what do we want our children to - to know and be able to do, so to speak, in each of our courses. Okay. So, now let's design our assessments and use it to study the assessments. And then let's look at those questions. Are they getting at what we want? [...] True data that informs instruction. Um. - is connected to instruction and has - you know, I'm not just talking about pre- and post- I'm literally talking about building in the formative pieces, the snapshots, the student goal setting, their progress monitoring of themselves...

For Dr. Trainer, the term data brought to mind a rich set of information directly tied to instruction. She explained that, to her, data are more than numbers and test scores. Her understanding of high quality data included information that teachers helped to generate and information that informed instruction, including formative assessments shared with

66

students. Dr. Trainer's personal definitions of data and data use were much broader and more elaborate than the implicit definitions established by the DDDM initiatives and teacher evaluation policies in place at the state and local levels. Despite this robust understanding of data, Dr. Trainer was still responsible for supporting administrators and teachers in the schools in her district to carry out the initiatives and policies already in place.

School-Level DDDM Initiatives

As indicated by Figure 5.1, Jefferson Middle School was subject to all of the DDDM initiatives at the state and district levels. Additionally, Jefferson Middle School had instituted its own school-level data days. Similar to the district-level data days, school-level data days involved teachers working together in grade level or subject specific teams to examine student data. Unlike district-level data days, school-level data days did not include any focus on creating data reports. Instead, for these days, data were provided to the teams of teachers in the form of completed Illuminate Ed reports. Teachers were then expected to discuss and interpret the reports. As a part of their interactions, teachers were also required to fill out paperwork based on their group discussions. Ms. Pell described her experience at school-level data days by saying:

> When we look at data at staff meetings they usually give us a big printout stack of
> papers. Either like, here's all the grade level, here's all your kids color-coded, or
> here's all the scores, or here's all your [state standardized assessment] scores
> categorized by individual strand. And then we fill out worksheets on it.

Ms. Pell explained that teachers were provided data, which could include a range of information about students. Ms. Pell's description of the data as "a big printout stack of

papers" was characteristic of participants' sentiments expressed about provided data. That is, participants expressed only limited engagement with completed data reports they received. Similarly, Ms. Jackson described her experience of receiving data from Jefferson Middle School administrators as, "Here it is. It goes in your binder, kind of thing." Ms. Jackson's description highlights that she accepted the information she was handed and then stored it away without further analyzing what she was given. I further discuss the themes I observed related to participants' interactions around these data in later chapters.

School-Level Teacher Evaluation Policies

At Jefferson Middle School teachers were evaluated using the district approved evaluation tool, discussed in detail above. Therefore, 75% of their evaluation was based on general pedagogical factors and 25% of their evaluation was based on student growth measures. The process for determining a teacher's general pedagogical competency involved observations of his/her classroom from Principal Martin multiple times per year and based on the district's established criteria for effectiveness (Table 5.1). Student growth measures at Jefferson Middle School included: (a) the course grades teachers assigned to students and (b) students' semester exam scores in those courses.

Through my interactions with participants I discovered the teacher evaluation system in place at Jefferson Middle School influenced participants' interactions with administrators around data, but did not necessarily encourage teachers to use data to improve instruction. Specifically, participants adhered to the teacher evaluation requirements and provided administrators with course grades and semester assessment scores. Participants provided these even they did not find them particularly informative related to understanding students' thinking or to changing their teaching practice.

Additionally, although the rubrics for general pedagogical practices comprised the vast majority of their evaluation (75%), participants almost exclusively focused on student growth data when discussing data for teacher evaluations.

Teacher evaluation policies at Jefferson Middle School shaped participants' data use by establishing requirements for participants to satisfy. These requirements, however, did not fit with the ways teachers would have used data otherwise. The explicit requirements of the evaluation policy prioritized course grades and semester assessment scores that participants did not prioritize in their other interactions. In particular, participants did not use these types of data to inform their instruction. I explore the ways participants discussed their uses of data in detail across the subsequent chapters of this study. It is not clear whether interactions around data with administrators could have been more constructive for participants if the requirements for teacher evaluation fit more closely with the data teachers used for other reasons.

In my discussions with Principal Martin, she acknowledged that she had not established any explicit expectations beyond teacher evaluation policy requirements for teachers regarding their data use. She collected weekly updates on which students were receiving failing course grades and used that data to inform her conversations with teachers. Principal Martin's focus on course grades in her weekly updates and teacher evaluations, contributed to the implicit prioritization of grade data at the school level.

Additionally, I observed dissonance between the ways Principal Martin described her understanding of the term *data* and the ways her actions shaped how data were defined at Jefferson Middle School. During our first interview, Principal Martin indicated that she generally thought of data in terms of numerical information, but she also

recognized that data could include written information about students such as their behavior. She noted that as a building principal she was exposed to data constantly.

Data is just information, so we're taking it in all the time. So you know when you - Typically when you look at data it's – We think of data being presented to us in some, some type of organized format. […] We all sort of try to get better at collecting data as some kind of organized format because we want to be able to use the data and go back and reference it.

Principal Martin explained that data is something principals and educators interact with regularly. Her statement, "We think of data being presented to us…" fit with the ways participants talked about receiving completed data reports from administrators. This statement shows Principal Martin considered data as something that was pre-existing or beyond her control. In her next sentence, however, Principal Martin described efforts to be organized about collecting data so that one can return to the data later and still make sense of it. In that regard, Principal Martin expressed agency for collecting and using data.

Although Principal Martin may have understood the term data to include a broad range of information about students and instruction, her interactions with teachers as a part of their evaluation process did not reflect that. When asked explicitly what kind of evidence Principal Martin would like to have seen from teachers to gauge student learning, she explained,

When I see evidence of student learning, um I guess it's, it's two-fold. Um. Sometimes I don't know if grades are the best indicator of student learning. Um. Probably, what I like to see - would like to see most is actual student work, because to me, that's reflective of student learning.

Principal Martin suggested that she found student work samples useful indicators of student learning. She also suggested that students' grades might not be as accurate a representation of student learning. This explanation stands in contrast to the teacher evaluation policies Principal Martin helped to enact at the school. Specifically, nowhere in the teacher evaluation policies or DDDM initiatives at Jefferson Middle School were student work samples prioritized as meaningful representations of student learning.

Participants also described student work as informative data for understanding student learning; however, teachers focused on those data only in interactions not mandated by policies and initiatives. The ways teachers discussed their data use are explored in detail throughout the subsequent chapters of this study.

CHAPTER 6: PORTRAIT OF USING DATA – OTHER STAKEHOLDERS AS

AUDIENCE

In this section I describe the consistent themes I observed in how participants discussed data in relation to administrators and parents. Participants did not explicitly group together administrators and parents. I, however, identified similarities in the types of data and evidence participants selected across these groups as well as similarities in the ways participants discussed how they used data with these audiences. Here I use the term *other stakeholders* to distinguish the ways teachers talked about data within accountability settings from the ways teachers used data and evidence for themselves and in discussions with other teachers.

Broadly, I observed participants' talk about using data in relation to other stakeholders included the following themes within each category of the Coburn and Turner (2011) framework: (a) *Noticing* data focused on standardized scores, (b) *Interactions around data* included limited interactions with other stakeholders and primarily passive positioning of teachers, (c) *Implications and uses of data* included data primarily used to justify prior decisions, and (d) the *Timescale for data use* involved past data used retrospectively over many months. In the following sections, I unpack each of these categories further and highlight their features through illustrative narrative examples.

Noticing Data: Focus on Standardized Scores

All participants indicated that if communicating with other stakeholders, they would share student test scores (i.e., Aimsweb screeners, semester assessments, and state

standardized assessments) and course grades. In fact, with the exception of Ms. Barton[4], all

teachers in the department indicated that grades and test scores were the *only* pieces of

information they would share with administrators because they thought those were the

only information administrators wanted. Of all of the data available to teachers at any point

in time, in relation to other stakeholders, participants attended to data directly along the

lines established by teacher evaluation requirements.

The example below is part of a narrative Ms. Barton shared when she described

interacting with administrators around data about students at the beginning of the second

semester. This example highlights how participants' noticing of data was shaped by

interactions with other stakeholders.

Example 6.1:

1	Ms.Barton:	So often times, for us [teachers] to really make our point valid…
2	Cavanna:	Mmm?
3	Ms.Barton:	*We have to have* data. And so, when we talk about placement of students,
4		when we talk about the ways that maybe, um, we should standardize things or
5		not standardized things, whether we should group them homogeneously or
6		not. *We have to have - we have to have* <u>immaculate</u> data for that because
7		she's [Principal Martin] not going to take any proposal based on what we
8		think. And neither is the district because parents are so insistent about what
9		they want. And if we professionally don't agree, *we have to have* <u>great</u> data
11		that supports what we think […] We're going to continue collecting data on
12		whether the CMP method is the - if that curriculum is good based on all the
13		investigative, you know, resources we have. And again, because those are
14		things that parents are not comfortable with unless it's a part of their
15		experiences. And so *we have to have all of this*. [Emphases Added]

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[4] Ms. Barton indicated that she might share a variety of data, which could include students' scores on early and late quizzes, homework examples, or writing samples.

Here Ms. Barton described that it was necessary for teachers to have data in order for their opinion to be considered valid. This is made clear through her repetition of the statement "we have to have" (lines 3, 5, 6, 9, 15). The sentiment that supporting one's opinion with data was not merely a good idea, but in fact mandatory, was echoed across participants' descriptions of using data in accountability settings. Ms. Barton also described the character of the data as being "immaculate" (line 6) or "great" (line 9). From this perspective, then, if a teacher were to "disagree professionally" (line 9) having any kind of data was not sufficient; instead, the teacher needed particular kinds of evidence considered valid for an audience of other stakeholders.

Participants indicated that the types of data that were considered "good" for the audience of other stakeholders were primarily quantitative measures of student performance, such as student test scores. In particular, they emphasized state standardized test scores for these audiences. Interestingly, although such types of numerical data were discussed with the highest priority in interactions with other stakeholders, participants characterized these data as being the least useful for informing instruction.

The following example from Mr. Hale illustrates his intentional use of quantitative and anecdotal data about students as a means to be convincing to other stakeholders.

Example 6.2:

```
1       If it's an academic issue, then it's going to be performance based.
2       Because everybody looks at the scores and and things. So, even if you
3       don't necessarily believe in those scores, you can always pull them out
4       if you're trying to make a point […] If I have a parent who is not believing that
5       a kid needs some extra help. I can pull out a [State Standardized Test] score
6       and say, "Look they weren't proficient. They're clearly not where
7       they need to be" Or an Aimsweb score or whatever. But I find that it
8       works a lot better. Then I can say, "Well look. I've worked with your
9       kid. I've sat down with them and they can't multiply six times seven.  And
10      that's a problem." If they're having so much trouble with math that
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11   they can't even think about the basic facts. I ask them to read this
12   problem and come up with something. And they're looking at me
13   and making random guesses. You know. And so a lot of it is going
14   to be that, that anecdotal kind of things because that's where I'm going
15   first. I can pull out the standards stuff I want to do a performance-
16   based thing. *But, somebody is going to want data. Somebody is going*
17   *to want numbers. If I want to contest it, I better have numbers to*
18   *back it up. And as much as I hate that, I have to have them. But, if I*
19   *REALLY want to convince somebody of something, I'm going to go back*
20   *the anecdotal,* as I mentioned. I've - I've talked to a kid. I've built a
21   relationship and this is what I've found out. And I believe I can
22   convince people of that, most of the time. [Emphasis added]

 In this narrative, Mr. Hale described a tension that resonated with all of the participants.

He described the tension between the kinds evidence that he found meaningful as a teacher

(e.g., anecdotes about working one-on-one with students, lines 7-14) and the kinds of

evidence that were widely accepted as convincing to other stakeholders (e.g., test scores,

lines 1-4; 13-15). In conversations with skeptical parents, Mr. Hale indicated that he would

focus on standardized test scores and talk about whether a student was meeting

proficiency expectations. Mr. Hale added, however, that he had found more success when

he can reference specific instances of working directly with a struggling student (lines 17-

20). Drawing on his many years of experience of talking with other stakeholders, Mr. Hale

acknowledged that although standardized quantified data were considered most valid, his

relationships with students were still important.

Interactions Around Data: Passive Positioning of Teachers

Across participants' talk about using data with other stakeholders, they consistently

positioned teachers and themselves as passive recipients of data requirements or

expectations. This positioning was observable through participants' use of inactive verbs

and passive voice when they described using data for other stakeholders. I highlight these

features using Example 3 from Ms. Pell. In this narrative, Ms. Pell explained how data factored into her and other teachers' evaluations.

Example 6.3:

1	Ms. Pell:	Okay. So a quarter of our evaluation was based on student grades
2		as well as the semester exam
3	Cavanna:	Okay.
4	Ms. Pell:	Ms.P: And they factored out students who are absent multiple times.
5	Cavanna:	JC: Mmm.
7	Ms. Pell:	But, otherwise - I'm trying to remember how many D's and E's we were
8		allowed. We were allowed so many D's and E's to be in each category. […]
9		I think it was six a marking period. Six or seven, depending on how many
10		school days we had. Maybe that's how many kids you could - I don't
11		remember.
12	Cavanna:	And, so then, was there any other data about students that played a role?
13		So it's a quarter of your overall evaluation?
14	Ms. Pell:	Yeah, a quarter of our overall evaluation. And then the rest is based on a
15		rubric of how you are teaching.

In this narrative, Ms. Pell used an impersonal tone. The only subjects with active roles were described using the pronoun "they" and it is not clear to whom specifically this pronoun referred – likely the building administration who conducted the evaluations of teachers at Jefferson Middle School.

Positioning herself passively, Ms. Pell described actions that happened to her, instead of actions she took. For example, in turn 5 she said, "We were allowed so many D's and E's to be in each category." As part of the evaluation process, teachers were limited in how many of their students could receive failing grades for their courses each marking period.

Assigning student grades is typically under teachers' jurisdiction. As a result of the accountability policies in place at Jefferson Middle School, however, teachers' agency to do

so was restricted. Consequently, teachers were positioned as under administrators' control, even within the realm of grades, which typically are exclusively the purview of teachers. Ms. Pell's narrative is characteristic of the ways teachers discussed their limited agency using data for other stakeholders.

In the last two turns of this narrative, I pressed Ms. Pell about the data that were used by administrators to inform teachers' evaluations. Ms. Pell confirmed the information I received from all participants and administrators. The teacher evaluation policy at Jefferson Middle School relied on teacher-assigned grades, grades that were limited by administrator input, as the only data to measure student growth. In this regard, teachers' professionalism was also undermined. Speaking about this policy Ms. Jackson shared the following:

Example 6.4:

  1   So no other factors besides grades are taken into that. And from a teacher to a
  2   teacher, you know that there are many many factors that influence a student's
  3   success in school. But ours is [measured by] just their grades. So you know, a less
  4   ethical teacher might say, "Well, I'll just manipulate their grades"[...] It's temptation
  5   that's for sure. [Laughs] It makes me feel bad that I could even be tempted to do
  6   that. It's just - that's not what it's about. So, yeah. Definitely the external influences –
  7   it just kind of makes everything more stressful. More number driven and not so
  8   much concept understanding and things like that.

Ms. Jackson admitted that the evaluation policy, based on teacher-assigned student grades, was a system that could be manipulated. Through reported speech of a hypothetical "less ethical teacher" she indicated that a teacher could be tempted to change students grades to make their own evaluation look better. Ms. Jackson used active verbs only to describe how a teacher might manipulate the system, but she disregarded this as a viable option because she suggested that dishonesty and gaming the system were not what teaching is about.

Instead, Ms. Jackson's example supports the characteristics of Ms. Pell's example in how the process of using data about students for evaluation is described with teachers as passive recipients.

Limited Interactions With Other Stakeholders. Participants' descriptions of using data in relation to other stakeholders indicated that these interactions were few and mostly one-sided affairs. In particular, participants' descriptions illustrated how they used data *for* other stakeholders, versus *with* other stakeholders. For example, participants did not describe working with other stakeholders to make sense of any student scores they presented; instead, participants described giving a score and leaving it at that.

Mandatory "data days" presents a scenario that highlights this characteristic of limited interactions around data with other stakeholders. On data days, time was allocated for teachers to work within departments and across grade levels around data produced using the Illuminate Ed software. Typically, teachers were given printed reports of student data from state assessments. Along with these reports, they were instructed to complete forms with questions about the data. As discussed in Chapter 5, Ms. Pell described this interaction as follows:

> When we look at data at staff meetings they usually give us a big printout stack of papers. Either like, here's all the grade level, here's all your kids color-coded, or here's all the scores, or here's all your [state standardized assessment] scores categorized by individual strand. And then we fill out worksheets on it.

Ms. Pell explained that particular data were pre-selected for teachers to examine and then presented to teachers during the data day meetings. Then, in order to keep track of

teachers' observations about that particular data, they were expected to record their ideas on worksheets.

It is likely that such forms were intended by administrators to promote discussions about the data. In the contrived setting of mandatory compliance, however, participants described the forms as a task to complete more than a venue for authentic discussion. Participants described submitting the data day forms to administrators, but they did not describe how those conversations related to any potential changes in their teaching practices.

Another example of the limited interactions participants described with other stakeholders around data is highlighted by the following comments from Ms. Jackson. In this example, she discussed who provided leadership or support for teachers using data about students.

Example 6.5:

1	Ms. Jackson:	So, we get it kind of from a lot of different- And then of course, data
2		comes from our secretary, data on students, things like that. But yeah, it
3		comes from a lot of different places.
4	Cavanna:	And do you feel supported in using that information, or it is more, like
5		you're presented with information?
6	Ms. Jackson:	Here it is. It goes in your binder - kind of thing.

In this instance, it is other stakeholders who were described as giving the data, instead of the teachers. Ms. Jackson noted that teachers were provided a lot of data, but teachers essentially just received the information without support to interpret or utilize it. Although data were exchanged between teachers and other stakeholders, there were only limited interactions surrounding those exchanges.

Implications and Uses of Data: Retrospective Justification

Participants were remarkably consistent in their purposes for using data in relation to other stakeholders. In nearly every instance, teachers used data to justify their actions or decisions to other stakeholders. These justifications typically occurred after a particular instructional action had already been taken, and as such data were used retrospectively in relation to other stakeholders.

In Example 6.1 above, Ms. Barton described how teachers needed to use data in order for their opinions to be considered valid. Consequently, teachers collected new data (e.g., quizzes, student work samples) and interpreted existing data (e.g., state standardized test scores) in order to defend their decisions and opinions. For example, Ms. Barton described teachers using data to validate instructional decisions that were made previously (e.g., student class placement, line 3) and larger plans (e.g., curriculum selection, lines 9-10). Likewise, in Example 6.2, Mr. Hale described drawing on pre-existing data and interactions as a means to convince parents of his perspective on their students' learning.

These instances are characteristic of the ways that all participants used evidence for an audience of other stakeholders. Specifically, participants selected evidence "after the fact," in defense of instructional decisions already made or in order to support their claims about students after instruction already occurred. These ways of talking about and using data were quite different from the ways teachers talked about using data with other teachers, in which they typically used data to help guide instruction. The historical nature of these uses of data is discussed further in the next section about the timescale for the data use.

Timescale for Data Use: Extended

Participants operated on a long timescale when using data in relation to other stakeholders. Since data such as state standardized test scores, semester exam scores or marking period course grades were available only a few times across the school year, making use of these data required operating across a broader span of time. The Aimsweb screeners could be administered as frequently as every two weeks, but since the administration prioritized scores from these tests given at three points across the school year (beginning, middle, end), in conversations with other stakeholders it was those three time points that were discussed. As a result of the data valued with the other stakeholder audience being collected infrequently, participants did not use these data to inform day-to-day lesson planning or to track student progress within a given marking period. Instead, these data represented teaching or learning over the course of many months.

All of the examples included in this chapter share these timescale features. These examples illustrate the ways participants discussed noticing data that had been collected many months before. In Example 6.2, Mr. Hale mentioned potentially using a state standardized test score as evidence to help sway the opinion of a parent (line 4). That test is only give once per year, so therefore that data would reflect the student's knowledge and skills from many months prior. The Aimsweb screeners he mentioned (line 7) were administered no more than every two weeks. So although a shorter timescale, even the more formative assessments he discussed represented students' knowledge and skills from an earlier point in time.

Similarly, in Example 6.3, Ms. Pell described the data used for teacher evaluations. She described how the evaluations were partly based on data from semester exams, which

occurred only twice per school year, and course grades assigned four times per school year. The teacher evaluations occurred only once very near the end of each school year. The data Ms. Pell described were submitted to the administration at that time in order to inform administrators' judgments of teachers summarized over all nine months of the academic year. Due to the extended timescale of data used in relation to other stakeholders, it is not surprising that participants did not discuss using the information formatively to shape upcoming instruction – the data were simply too old at that point to be particularly useful in relation to: (a) the content they were teaching next or (b) students' current knowledge and skills.

CHAPTER 7: PORTRAIT OF USING DATA – TEACHERS AS AUDIENCE

In this section I describe the consistent themes I observed in the ways participants discussed using data for themselves and using data with other teachers. Broadly, participants' talk about using data in relation to teachers, including for their own use, included the following themes within each category of the Coburn and Turner (2011) framework: (a) *Noticing* classroom-generated data, (b) *Interactions around data* included collaborative interactions and active positioning of teachers, (c) *Implications and uses of data* included using data to inform instruction, and (d) the *Timescale for data use* was short term including data used to inform next steps in instruction. In the following sections I unpack these categories further including using illustrative narrative examples.

Noticing Data: Classroom-Generated Data

Participants showed a significant preference for using data they had a hand in shaping as compared to data generated from other sources such as standardized tests. Discussing data about students from their classes, participants often described examining student work and conducting formative assessments. Most often when participants talked about formative assessments they described small, one or two question, "exit tickets." They also discussed using students' written classwork and ideas captured on individual whiteboards, along with listening to students' responses during class discussions. All of the participants briefly noted ways that they could use standardized data, such as that from Aimsweb screeners, but none of them focused on these data as a central component of their routines to consider student progress. Instead, participants favored informal interactions with students. These interactions allowed participants to get a sense of where students were coming from and what students were thinking. The participants attended most to

what students could say and do through varied interactions, including small and whole group class discussions. Participants then used those data, referred to here as *classroom-generated data*, to gauge students' progress and evaluate the effectiveness of their instruction. Examples 7.1 and 7.2 below are characteristic of these themes.

Unlike some of the PD activities, which participants occasionally found to be new and challenging, many of the activities that produced classroom-generated data grew out of participants' regular classroom teaching practices. Many of these activities were already a part of participants' practice even before the start of the MDISC PD project two years prior, while others were more recently acquired with the help of the MDISC PD focused on mathematics classroom discourse. These newer practices were also a primary data source for participants' efforts to improve their teaching and were a point of change as the year progressed. In fact, all of the participants described improving their formative assessment practices over the course of the school year. Example 7.1 highlights the features I observed in how participants talked about using classroom-generated data as a means for formative assessment. This example is taken from Ms. Barton's third interview as she described how she was considering student progress.

Example 7.1
1 I'm considering their progress in traditional ways- looking at their assessments,
2 looking at their daily work. But the big difference is that I feel because of the discourse
3 work, whether it's a high level task or not, but because of our discourse work, my
4 formative assessing is SO much better than it has ever been in my entire career. I feel as
5 though by the end of the class period, I know who… I know who gets it, I know who is
6 struggling and to what to degree, based on their participation. And by monitoring and
7 making sure that I am getting participation from everyone, I…I know…I know who I
8 know about and who I don't know about. So it makes… it makes it so much easier, and I
9 am so much more effective in staying in touch with kids than I ever have been in my
10 entire career. Even last year. […] This is better this year. Ten times better!

In this excerpt, Ms. Barton emphasized how her efforts as a part of the MDISC PD activities, what she referred to as "discourse work," helped her improve her formative assessment practices. Specifically, in lines 4 – 8, Ms. Barton explained that by attending to student contributions to class discussion she received valuable data about which students were struggling. And Ms. Barton explained that through her efforts to encourage participation from all students she had a clear understanding of the students for whom she lacked information. Ms. Barton's emphasis that her efforts during the present school year were better than ever before were echoed by all of the participants. Across the group, participants described their efforts to make use of classroom-generated data as very effective and continuing to improve. They supported such descriptions with data they shared during action research study group sessions, including classroom video and examples of student work used formatively.

Another example, Example 7.2 taken from Mr. Hale's second interview, emphasizes the informal nature of the classroom-generated data participants found useful.

Example 7.2:

1	Mr. Hale:	[...] having um, pictorial evidence of what they learn, writing anyway.
2		You know, instead of collecting papers just about things we're doing in
3		class, having those whiteboards and being able to walk around and
4		snap a picture and talk to a kid about a specific question. I think that
5		has given me a lot more insight into how more kids are thinking.
6	Cavanna:	Mmm.
7	Mr. Hale:	I think we always hear from the vocal kids. And we always have a good
8		idea of what the top kids are thinking because they're thinking pretty
9		much what we want them to think. It's those little quiet kids that we
10		don't always hear from. They're shy, they're quiet, they're not always
11		sure what kinds of connections they're making. So, thinking about how
12		I can get a better handle on where they're coming from and where
13		headed. I just think that the video and pictures and the big white
14		boards where they have to write - those big whiteboards are so good.

Mr. Hale discussed his efforts to gather and use data from students during class. Specifically, Mr. Hale described asking students to record their classwork on large whiteboards and talking with individual students. This classroom-generated data provided him real-time insight into what students were thinking, which he could gather by snapping photos and talking with students, instead of collecting and reading papers (line 1-5). Taking photos of those whiteboards also allowed Mr. Hale to record that data for later analysis, which became a part of his action research efforts. I discuss the ways teachers used data in the context of action research in detail in a later chapter. In this example, Mr. Hale's description of using a variety of classroom-generated data is decidedly positive. Specifically, in the line 5 he indicated that his informal activities gave him "a lot more insight" into student thinking than other activities such as typical unit assessments or state standardized test.

Additionally, Mr. Hale described how his informal processes of gathering data provided him insight into the thinking of traditionally quiet students. Through his use of the whiteboards, photos, conversations, and video recordings, he was better able to access what all students knew and could do, including students he traditionally found hard to access.

For an audience of teachers, classroom-generated data, including student contributions to classroom discussions, was extremely informative. Participants consistently described the ways their instruction was informed by their increased efforts to attend to students. They also discussed how they used these data as they worked together to plan for and reflect on lessons.

Interactions Around Data: Active Positioning of Teachers

I observed a reoccurring theme that when participants discussed data for a teacher audience they consistently positioned themselves and other teachers as active agents in the work of noticing, interpreting, constructing implications and taking action on data. This positioning was evidenced by participants' use of active verbs and active voice when they described using data for a teacher audience as a part of their daily work and in the context of the action research study group.

The following example, Example 7.3, is characteristic of the ways participants talked about themselves and other teachers using data for a teacher audience. Example 3 came from Ms. Pell's first interview as she described the differences between the data she would share with other stakeholders as compared to what she would share with another teacher.

Example 7.3:

1	Ms. Pell:	Um. Well, like for the administration, we just gave them the grade.
2		So, there was no learning target standard discussed.
3	Cavanna:	MmHmm.
4	Ms. Pell:	But like if [Mr. Hale] and I were going to sit down and have a
5		conversation we'd have a specific target in mind. And we'd say, here's
6		the kinds of things we're seeing students do. Different kinds of
7		misconceptions that we're seeing, based on so-and-so's paper. We're
8		seeing kids do this. Or this group thought about it this way, kind of thing.
9	Cavanna:	MmHmm.
10	Ms. Pell:	So, we'd be much more specific.
11	Cavanna:	It sounds like more specific and also, would you say like a deeper,
12		um - like a deeper investigation?
13	Ms. Pell:	Yeah, definitely. Because we're thinking like a more day to day,
14		how did the lesson go? Where do we want to go next?

As was typical of most narratives, Ms. Pell collectively referred to what she and Mr. Hale would do together, using the pronoun "we" throughout the example. I discuss the theme I observed related to the ways participants described their collaborations further below.

When Ms. Pell described what evidence she would share with an administrator (line 1), she said, "...we just gave them the grade." In this phrase, Ms. Pell's use of the word "just" emphasized that she simply handed over a piece of data, numeric course grades. As described in the previous chapter, in the context of using data for an audience of other stakeholders, Ms. Pell indicated she had minimal control or interaction in this exchange. In contrast, in lines 4-8, when Ms. Pell described what would happen when she and Mr. Hale shared evidence with each other all of the verbs she used described actions (e.g., sit down, have a conversation, seeing students). Ms. Pell described her and Mr. Hale as taking intentional steps (e.g., "we'd have a specific target in mind") to attend to and interpret specific data (e.g., misconceptions on a particular work sample (line 7)). As was characteristic of how participants discussed data with other teachers, Ms. Pell's description shows how she and Mr. Hale exhibited control and intention in their responses to data about students. That is, she described them as agentive in their data use when their audience was each other, teachers.

Another illustrative example of the ways participants actively positioned themselves and other teachers is Example 7.4. Example 7.4 was taken from Mr. Hale's response to when he was asked to tell about a time when he had interacted with an administrator about data or evidence related to student learning. Mr. Hale began by indicating that he had not had any interactions with administrators about data. Instead, he focused primarily on the ways he worked collaboratively with Ms. Pell.

Example 7.4:

1	Mr. Hale:	Like I said, [Ms. Pell] and I talk all the time now that she's back
2		[from maternity leave]. [...] And so she and I talk everyday at least a little.
3		And today we spent four hours at school. And a good portion of that was
4		talking about what kind of evidence we have for the kids' growth. You

5		know, what kinds of measures are we looking at? Why are we doing this?
6		Why are we asking this question? What investigations? So, I I think the
7		end result is, what do we want kids to know, and how do we know if they
8		know it? And so if we're trying to answer how do we know if they know
9		it, we're really looking at data.
10	Cavanna:	MmHmm
11	Mr. Hale	And I talk about the types of activities that we want to use, the
12		questions we want to ask, the types of results we're hoping to get from
13		those questions and activities, and how we're going to judge whether or
14		not it's what we're looking for.

Mr. Hale described regularly spending time working with Ms. Pell, including many hours on the Saturday of the interview. During those hours, Mr. Hale described how he and Ms. Pell discussed the evidence they had to measure whether or not students were learning mathematics. Mr. Hale used a series of rhetorical questions to outline their concerns. Mr. Hale described their focus on considering the questions they ask of students and the activities in which they engage students along with their expectations for how students should perform.

Throughout this example, Mr. Hale described himself and Ms. Pell as active agents asking themselves specific questions as they planned for instruction. His description positions them as thoughtful practitioners who take control of the situation by planning and questioning both their intended outcomes (e.g., "what kinds of measures are we looking at?" (line 5), "what do we want kids to know?" (line 7)) and the means by which they worked to achieve those outcomes (e.g., "Why are we doing this?" (line 5), "the types of activities we want to use" (line 11)). These kinds of subtle markers of agency were characteristic of the ways all participants talked about using data for and with an audience of teachers.

The questions Mr. Hale posed in Example 4 do not focus on any particular form of data (e.g., a test), but instead outline the kinds of information the teachers need to collect and interpret from students. He said, "So, I – I think the end result is, what do we want kids to know, and how do we know if they know it? And so if we're trying to answer how do we know if they know it, we're really looking at data" (Turn 5). Mr. Hale described the activity of using data as trying to answer questions about what students know. As such, teachers were positioned as central to the work of using data because they both ask and seek answers to the questions about students' understandings.

Interactions Around Data: Collaborative Interactions Among Teachers

Collaboration was pervasive within the mathematics department at Jefferson Middle School. Throughout the school year, participants collaboratively worked together in all aspects of their teaching practice, including lesson planning, instruction, and reflection. Participants worked closely as grade-level pairs regularly sharing the same lesson plans and always using common assessments. The prevalent collaboration among participants was a theme reflected in the ways they discussed data and evidence in both interview and study group settings. Participants consistently used the collective pronoun "we" to describe their work as teachers. Rarely did participants share stories that used the pronoun "I" to discuss their teaching efforts.

Example 7.5 illustrates these discursive markers of collaboration among participants as they used data in relation to other teachers. In this example, Ms. Barton described an instance when her instruction changed as a result of data she had about students. The pronouns and possessive pronouns have been highlighted for emphasis here.

90

Example 7.5:

1	Cavanna:	Can **you** tell me about a time when **your** instruction has changed
2		as a result of data **you** had about students? And if it hasn't changed,
3		then **you** can tell me about that.
4	Ms. Barton:	Okay. Well, **we** made some decisions based on some things that
5		**we** collected. Um. **They** totally understand this, it doesn't make sense
6		to put another day into it.
7	Cavanna:	Mmm.
8	Ms. Barton:	**We** think that based on **our** discussions about transformation,
9		early on when **we** first visited the families of functions, and based on
10		the data from their assessment on that unit, how now that **we** are
11		specifically looking at exponential functions […] **we're** going to spend
12		very short amount of times on that just going over what **we** did with
13		**our** families of functions and transformations because **we** know **they**
14		really demonstrated some strong understanding of of function
15		families and transformations.
16	Cavanna:	Mmm.
17	Ms. Barton:	So, **we** don't need to spend a lot of more time on that. Just
18		review it as it relates to exponentials, and move on.

The question was posed in the singular, directed just to Ms. Barton, prompting her to talk about her own teaching (lines 1-2). Throughout her response, however, Ms. Barton used the plural pronoun "we" as she described her and Ms. Jackson's decision to move forward with instruction more quickly than originally planned because students already demonstrated a strong understanding of the content. Some of the "we" pronouns might refer to the class as a collective, but the instances in lines 4, 5, 8, and 13, clearly refer to Ms. Barton's and Ms. Jackson's using data to plan their instruction. Ms. Barton's response in Example 5 is characteristic of the ways all participants collectively referred to themselves and other teachers. In addition to simply working together, participants used data interactively, including many back-and-forth discussions as they made sense of their data and what it might mean for the instruction.

Implications and Uses of Data: Using Data to Inform Instruction

Participants primarily used data about their students in order to inform their mathematics instruction. In addition to using data from tests and quizzes, participants also engaged in a range of formative assessment practices, including giving significant attention to students' verbal and written contributions during class. Then, participants interpreted the range of classroom-generated data to which they had access and used that information to plan new instruction or to reflect upon the effectiveness of instruction that had already taken place.

The following example illustrates the ways participants talked about using data to inform their instruction. Example 7.6 is an excerpt from a longer narrative in which Mr. Hale discussed how his instruction was changing as a result of data he had about students. Leading up to this excerpt, Mr. Hale described the work he and his colleagues had done to find rich, open-ended mathematics tasks that were engaging for students and which provided opportunities for students to communicate about mathematics. In addition to changing their curriculum, Mr. Hale emphasized the degree to which he had slowed down his instruction. He gave the specific example of spending more than twice the number of school days working on positive and negative numbers this year than he had ever done previously. Example 6 follows from a press on Mr. Hale to specify what data he used to make such decisions.

Example 7.6:

 1   I mean we've got data, we've got the whiteboards, we've got written work, we've
 2   got classroom discussion… And of course classroom discussion is mostly
 3   anecdotal, but some it's on video. And you - you see more, I don't want to say
 4   issues, that's not quite the right thing. It's not quite misconceptions. You know,
 5   more lack of connections from more kids. When you're kind of thinking more

6   about the curriculum than you are about what kids are doing and showing and
7   learning, I think that we tend to go through things much more quickly… But by
8   engaging kids in more open-ended dialogue and engaging kids in doing more
9   kinds of things during class, and giving more kids a chance to engage, we're
10   seeing where there's more issues. And then we tend to slow down and backtrack
11   and go around the corner again. You know, we're not moving on

This excerpt highlights Mr. Hale's experience of paying close attention to what students knew and could do and using that to impact what and how he taught. Specifically, he indicated that having more detailed and accurate data about what his students knew and could do, he felt obligated to spend more time working on particular mathematics content. He said, "we're seeing where there's more issues" and that caused him to find more ways to engage students in the same ideas and spend more time to support students to gain more experience and clear up any remaining misconceptions they might have. Often participants' experiences using data to inform their instruction mirrored Mr. Hale's efforts to slow down his instruction, but not always. In contrast, Example 5 above, from Ms. Barton, illustrates that sometimes participants used data about their students to make decisions to accelerate their instructional plans. In both cases, however, participants interpreted data from their students in order to make informed decisions about how those students' needs could best be met.

In addition to using data from and about students to inform instruction, participants also used data about their own instruction to inform changes in their teaching practices. As part of their action research efforts and prompted by prior PD activities, all participants collected video recordings of their classrooms. They later analyzed these video recordings and discussed their observations in the study group. Participants made a variety of observations about their students and their instruction, including for example, observing

the quantity and quality of student participation. They also made observations about the effectiveness (or lack thereof) of their efforts to employ particular discourse teaching moves. Participants indicated that analyzing videos of themselves teaching was particularly enlightening, especially in instances where they thought they were teaching a certain way, only to realize after watching the video that they were not. Thereby, these realizations prompted participants to change their instruction to better address the situations they observed (e.g., provide more opportunities for students to engage directly in student-to-student conversations).

Timescale for Data Use: Short-term

Using data for a teacher audience, participants discussed purposeful ways to guide their next steps in instruction. In these conversations they were primarily concerned with day-to-day interactions and how they could quickly adjust their plans in order to better meet the needs of their students. Consequently, for a teacher audience, data use was practiced on a short-term timescale. Particularly, in the context of their daily work, participants often noticed data generated from just minutes before they took action on it (e.g., students' responses during class discussions). In the action research study group sessions, participants talked primarily talked about data on a short-term timescale, especially when describing what they had been working on since the last group meeting (meetings occurred at least once per month) and in informal discussions of what they were observing in their classes. There were times during the study group sessions, however, where participants described data on a longer time scale, but in those instances the audience of the data use shifted to a research audience. I describe the themes I observed for research audiences in the next chapter.

CHAPTER 8: PORTRAIT OF USING DATA – RESEARCHERS AS AUDIENCE

In this section I describe the themes I observed in the ways participants discussed data and evidence in relation to a research audience. Specifically, I observed these themes in how teachers talked about using data for research with: (a) me, the researcher for this study in interview settings, (b) the PD facilitator, who was well known to the participants as a university researcher, and (c) one another as teacher researchers during action research study group sessions. In both interviews and study group sessions, the audience members physically present also served as proxy for a larger research community to which participants appealed. I posit that characteristics of participants' discussions with these audiences support a robust picture of how participants made sense of data and evidence.

Broadly, I observed participants' talk about data for a research audience included the following themes across my analytic categories: (a) *Noticing* data involved participants' broadening interpretations of the term "data" and the role data played in their action research plans; (b) *Interactions around data* included support and active positioning and expressions of agency by teachers; (c) *Implications and uses of data* included using a range of evidence to support claims related to action research work; and (d) *Timescale for data use* involved data use across extended periods of time looking backwards as well as planning for the future.

Noticing Data: Interpreting the term *data*

At the time of this study, teachers and administrators in the Greenville School District had been engaged in concerted efforts to use data for at least five years. I learned, however, through interviews with participants, building and district administrators, data coaches, and instructional coaches, that no stakeholders had ever previously had a

conversation about their understanding of the term "data." Consequently, interpretations of what was meant when people used "data" remained implicit and the term was not used consistently. Here, I present findings regarding the ways participants' interpretation of the term "data" shifted and expanded across their year of conducting action research and talking explicitly about collecting and interpreting data. The ways participants interpreted the term "data" was also tied to their understandings of what types of data they considered legitimate for use with a research audience. I discuss the ways teachers used data in relation to their action research in the next section.

At the beginning of the year, all participants expressed some degree of dissatisfaction or negativity when I asked them what came to mind related to the word "data". Their first reactions were to consider data as discrete, static numbers perhaps in a spreadsheet, particularly those linked to standardized testing. Participants explained that they were disappointed by these perceptions of data because they knew that their vision of limited, numerical data was not particularly informative to their daily teaching practices. Similarly, even though they recognized that data could include a range of information, they had difficulty conceptualizing how one might use data beyond numerical data.

For example, in our first interview in September, after I described my interpretation of "data" as a broad range of information including both qualitative and quantitative elements, Ms. Jackson responded,

> I mean, it all makes sense, it's all data. But, when I think of my spreadsheet of data, it's all right in one spot. It's accessible. It's more user-friendly. It's useful. Versus when it is about, like a plethora of things, then I just - it's not user friendly, so I don't use it.

Ms. Jackson acknowledged that there is a range of types of data, but she felt most comfortable with quantitative data organized in a form to which she was accustomed. Although data in spreadsheet form does not inherently make that data easier to use or more connected to teachers' daily work, Ms. Jackson indicated that having the data all in one place made it accessible to her. It is likely that her conception of data was also influenced by her prior experiences with information labeled "data." For example, the data participants received from administration and output reports from the Illuminate Ed software management systems fit the characteristics Ms. Jackson described.

Another example of how participants described their initial frustrations with the idea of "data" comes from Mr. Hale. As during our first interview in September, Mr. Hale explained a disconnection between how he used data and his understanding of the meaning of the term "data."

I would argue that the relationship stuff and how kids feel and all that perception things, that's all data. But it's incredibly difficult to quantify. But I would still argue it's data. But if you ask me what data is, I'm going to come back to that definition that means that it's quantifiable. It's kind of a dichotomy.

Mr. Hale described his opinion that qualitative information about his students (e.g., their feelings, relationships) should be part of the set of information that counted as "data." When asked to define "data," however, Mr. Hale admitted that he would likely exclude qualitative information because he defined data as being "quantifiable."

The examples from Mr. Hale and Ms. Jackson are representative of how participants struggled to consider their understandings of the term "data" and how that affected their

uses of data. Early on, participants identified gaps between their understanding of the term

"data" and the ways they used information from their classroom.

As the year progressed, participants began to reconcile their discontent with the

term data as they described and used data in broader ways. For example, in Example 8.1

taken from an interview in January, Mr. Hale explained his early challenges with using

qualitative classroom data.

Example 8.1:

1	Mr. Hale:	Corralling and really understanding the, the verbal engagement [has
2		been a challenge]. So, how do I – how do I quantify – which I don't
3		necessarily need to do. But how do I make data be useful that's just in
4		a regular classroom setting, that's not written work, that's not
5		something that I can easily um, look at and kind of sit back and think
6		about? So, the videotapes are fine. But [...] what do you do with a
7		videotape? How is that data that is really useful? So, what do I want to
8		be looking for? Or how do I, you know, set up any kind of collection
9		tool to say I need these thirty-seven seconds of the videotape? That's
10		very difficult for me. And that's what [the PD Facilitator] has been
11		pushing me about with the action research. You know?
12	Cavanna:	Mmm
13	Mr. Hale:	It can't just be written work. There's got to be the teacher discourse
14		moves involved. And you know, what proof do I have that the teacher
15		discourse moves are actually making any certain difference? There
16		are so many variables. The challenge for me is that that nebulous data.

Mr. Hale wondered how he could quantify or make useful data that included videos

and student "verbal engagement." He also went onto ask rhetorical questions about the

usefulness of watching video and determining what information in that video is important.

Additionally, he noted the ways the PD Facilitator pushed and supported him to think more

deeply about what "proof" he has that his use of teacher discourse moves were having the

impacts on students that he suspected. Looking at student written work alone would not

allow him to make connections between his teaching moves and the work he was

analyzing. The issues Mr. Hale expressed about qualitative data in Example 1 are representative of the challenges faced by all participants.

By the end of the year, participants talked about "data" as including a broad range of qualitative and quantitative information. For example, near the start of April, Ms. Barton explained that she considered data to be,

> Pretty much anything that describes the way students think about something. What they've produced on paper, how they interact with others in the classroom – whether it's in their partner groups or what they've chosen to share in whole group – piece of homework, an assessment. [...] Just anything that I can get my hands on or my eyes on or my ears on that represent how they think about what it is we're working on, the concept, how they view that.

Ms. Barton's explanation is characteristic of the ways that participants' later understandings of data valued any kind of information that allowed them to access student thinking or learning. This included observing students interacting in small or whole group settings and looking at student written work.

Despite their initial challenges of "corralling" qualitative data (Example 8.1), over the course of the year, participants described many advantages of broadly defining data. For example, Ms. Barton explained that her understanding of data changed completely by our final interview at the end of May. She explained that her new, more inclusive, understanding of data had positive consequences for her instruction. She said,

> I feel like now it's [the data I use is] a very accurate, um, [pause] it's very, it's more accurate in terms of where [students] really are, as opposed to this average grade, or this, all of these scores.

99

Ms. Barton explained that her use of many different types of information about students, including their verbal and written contributions during class, helped her to develop a more accurate understanding of what students knew and could do. Ms. Barton's explanation was representative of the ways participants described data by the end of the school year. Participants ultimately found collecting and analyzing "messy" data, including video recordings, to be informative in ways beyond what they learned from their typical teaching activities and beyond data that was cleaner or easier to use.

Noticing Data: Data to Inform Action Research Plans

At the same time that their understandings of the term "data" were shifting, participants also grappled with deciding how to use data to inform their action research and what data "counted" or were considered valid for use with a research audience. It was not clear whether data they found informative for the teaching could also be used for research purposes. Example 8.2 is an excerpt of a narrative from Ms. Barton's second interview in which she shared a story of how her students' learning of mathematics was changing.

Example 8.2:

1	Ms. Barton:	We even had a freshman Algebra One teacher weigh in and say that
2		she noticed that this fall the group that came in - who, by the way
3		were extremely naughty and not very cooperative, in terms of being
4		student. They did half of the review that they traditionally have done
5		because students understood it [the mathematics content] so well and
6		could articulate it and explain it so well. And I'm - we used the same
7		activities, the same assessments, everything. We really didn't change a
8		lot of our activities until this year when we really started talking about
9		really how great the investigations… kind of that process how that
10		affected student outcomes.
11	Cavanna:	MmHmm.
12	Ms. Barton:	So, to us, that was really great information. *And again, she didn't*
13		*provide us with anything factual, that was just what she's seen.*

14   [emphasis added]

In lines 1-10, Ms. Barton told a story about one of the high school mathematics teachers who taught the next course in the sequence following those taught by Ms. Barton and Ms. Jackson. This high school teacher told the Jefferson Middle School mathematics department that she taught just half as many review lessons as she normally would because the students who graduated from Ms. Barton and Ms. Jackson's classes the past year demonstrated such strong understanding of the mathematics.

One can see that Ms. Barton found the story informative because she stated that it "was really great information." Additionally, Ms. Barton shared the story with me, the researcher, as evidence to justify her claim that her students understood more mathematics and more deeply than previously. At the same time, however, Ms. Barton ended her recounting of the story by consenting that the algebra teacher did not share "anything factual," but merely "what she's seen" (line 13). Thus, despite its usefulness to her as a teacher, through her use of qualifiers, Ms. Barton indicated that the algebra teacher's story did not qualify as valid data for research. Ms. Barton's excerpt is illustrative of the ways participants struggled to balance information that they used to get a sense of their practice or about students, compared to data that they thought could be considered legitimate for a research audience.

Often participants referred to less legitimate data as being "based on experience" or "anecdotal." For example, Example 8.3 is an excerpt from Mr. Hale's second interview in which he described instructional changes he and Ms. Pell were making. Mr. Hale explained that they had significantly slowed the pace of instruction after they started piloting the

Connected Mathematics Project (CMP) curriculum. Mr. Hale said that the change in pace was because he and Ms. Pell were responding to what they thought students were "actually learning" based on the data they had. Example 3 is Mr. Hale's explanation when I pressed him to specify the data they used to support the decision to slow down.

Example 8.3:

1 I would say all of these things. I mean we've got [test] data, we've got the
2 whiteboards, we've got written work, we've got classroom discussion. *And of course,*
3 *classroom discussion is mostly anecdotal, but some it's on video*. And you - you see
4 more, I don't want to say issues, that's not quite the right thing. It's not quite
5 misconceptions. You know, more lack of connections from more kids. When you're
6 kind of thinking more about the curriculum than you are about what kids are
7 doing and showing and learning, I think that we tend to go through things much
8 more quickly. [...] *But by engaging kids in more open-ended dialogue and engaging*
9 *kids in doing more kinds of things during class, and giving more kids a chance to*
10 *engage, we're seeing where there's more issues.* And then we tend to slow down and
11 backtrack and go around the corner again. You know, we're not moving on.
    [Emphasis added]

Mr. Hale described how he and Ms. Pell used a range of data to help decide whether or not to move on to new content. They used data from students' written work on individual whiteboards, student work on paper, and students' contributions to classroom discussions (lines, 1-3; 9-12). Speaking about classroom discussions Mr. Hale said, "And of course, classroom discussion is mostly anecdotal..." (line 3) Describing particular data as *anecdotal* was one way that participants indicated that that a data source was possibly less reliable, often based too much a teacher's personal impressions to be used with a research audience. He went on to say, however, "...but some of it's on video" (line 3-4). Thereby, Mr. Hale suggested that by recording class discussions on video the status of that data was elevated beyond *anecdotal,* and thus it could be considered as evidence for use with a research audience.

Example 8.3 is characteristic of the ways participants explored how to use data as a part of action research. That is, participants discussed data they noticed with the action research study group and PD facilitator. These discussions often included descriptions of the changes participants hoped to see in their classrooms and the kinds of data they collected to help capture those changes. Participants regularly discussed how the data they examined helped them see more clearly how their instruction and students interactions in their class were related. In particular, they acknowledged that they were often not previously aware of how those pieces fit together. Video recordings appeared as a common theme in such discussions as a means to make classroom instruction and student interactions observable for research purposes.

The excerpt below, Example 8.4, is taken from the seventh study group session of the year, which took place in January. In the excerpt, Ms. Jackson recounts what she recently noticed related to her action research efforts.

Example 8.4:

1	Ms. Jackson:	I'm still focusing on just me doing discourse moves. That is what I
2		wanted to focus on discourse moves because I don't think I did it very
3		well this year. I mean last year.
4	Facilitator:	Can you remind us which ones you wanted to focus on doing more?
5	Ms. Jackson:	I was focused on me Probing, me Waiting, and me getting the students
6		to revoice. So I recorded bunch of videos and I just watched a few of
7		them. And like you said, I'm just so - I watched them. Because I
8		thought I was doing more than I actually am doing. I think my very
9		first video was in October. And in general, I just did a terrible job on
10		everything.
11		[Group Laughter]
12	Ms. Jackson:	Well, it was in October so I'm okay saying that. [laughter] And when I
13		started looking at December I definitely saw more probing. I started
14		recording kids responses and compared to when they explained and
15		said more stuff. And they definitely increased with more Probing. But
16		just like everyone said, I'm not Waiting. I feel like I'm waiting and I'm
17		not waiting at all. Comments I made, "I feel like I'm answering my own
18		questions.

19		[Overlapping talk. Laughter]
20	Ms. Jackson:	This is really important for me to watch these videos because I don't
21		even realize I'm doing it. But now that I'm conscious of it - Like I'll
22		take some new videos. I think that this is really going to help me be
23		more aware of this. I think that I Revoice but I do not ask them to
24		Revoice each other. Those are some things that I really - I will be
25		focusing on. In general, I have like every sequential video, they are -
26		more kids are giving me more - deeper answers. But, um, I think now
27		that I'm more aware of it. I hope like, these videos that I'm doing in
28		January now are going to get better. I just need time to watch it. So
29		many videos.
30	Facilitator:	Yeah. So, Yeah. Don't - I mean just pick a couple. Pick early, some
31		middle, some at the end. Or one, one, one. Not so many.
32	Ms. West:	The patterns will probably be the same.
33	Ms. Jackson:	I think so too. But this has been really beneficial for me to just watch
34		them because I thought I was doing more. And I thought that I was
35		getting less responses than I was. I was actually getting better than I
36		thought. You know, a lot of simple answers but there are some ones.
37		And that very first video in October it was just *terrible.* Frowny faces
38		all over my notes.

Ms. Jackson described recording multiple videos of her classroom instruction. She later

watched those videos and focused on her efforts to use more teacher discourse moves, in

particular, Probing, Waiting and Revoicing. Ms. Jackson explained that she realized her

instruction was lacking many of the characteristics she hoped to see. For example, in lines

15-18 she described how she thought she was waiting and giving students plenty of time to

generate responses to her questions. After she watched the videos, however, she realized

that she was not waiting nearly as long or as often as she had thought, and at times, she

even answered her own question without waiting at all.

Instead of framing her discussion around seeking answers to a particular research

question, Ms. Jackson described her targeted efforts to improve her instruction. This was

typical for all participants. Participants noticed and discussed data that informed their

change efforts to improve instruction and student learning and participation. Example 8.4

is also characteristic of the ways participants discussed data for the research audience

because Ms. Jackson attended to: (a) her immediate efforts to improve her classroom instruction and (b) evidence indicating whether or not her efforts were having the desired effects on her students. Additionally, Example 8.4 illustrates many of the characteristic interactions that occurred as participants interacted as teacher researchers during study group sessions. These interactions are discussed further in the following sections.

Interactions Around Data: Supportive and Collaborative

I observed the action research study group to be a welcoming and supportive environment. In particular, participants consistently shared many of the disappointments and challenges they faced as a part of their research efforts along side their successes. The group dynamics were such that individuals often took turns sharing stories from their classroom and thinking through their research efforts aloud. Other members of the group would then typically offer feedback, including tokens of encouragement, empathy, suggestions or advice.

Example 8.4, above, from Ms. Jackson highlights many of these features of interactions. During the study group session, Ms. Jackson was the fourth participant of the session to share her recent observations and insights. She began her story by identifying instances in her data where she thought she had been more successful, but realized her instruction was lacking. Specifically, in lines 9-10 she admitted, "... I just did a terrible job on everything." This was followed by laughter from the group. Similarly, in lines 17-18, Ms. Jackson's comment, "I feel like I'm answering my own questions" was followed by overlapping talk and laughter. As was common in the action research study group, participants found humor in their mistakes. They often joked about how they felt like they were worse teachers than they previously realized. This was humorous to the group,

because they consistently discussed how many improvements they were making as teachers and how they were providing much richer experiences for their students.

Additionally, the moments of laughter punctuated participants identifying common struggles. For example, much of the overlapping comments in line 19 of Example 8.4 included participants confirming that they too had experienced feeling like they were providing sufficient think-time for students only to later realize they were not even close to what they had thought. Laughter was a common interaction among participants and researchers. The humor expressed was typically self-deprecating, warm and supportive of whoever was speaking. I did not observe any instances of insults or unconstructive criticisms, neither outright nor veiled as humor.

Most of the action research study group sessions ramped up informally, with participants first chatting casually about their school days or families. After the PD facilitator called the sessions to order, one of the major events of the sessions included participants taking turns summarizing what they were currently doing in their research efforts. These summaries included discussions of progress, questions, and challenges participants were facing. Considerable time was devoted to each teacher and the rest of the group actively offered suggestions or constructive feedback in response to what was shared.

Example 8.5 is an excerpt from the fifth study group session in November, near the end of the fall semester. This characteristic exchange took place as Ms. Barton explained her early action research progress. The original exchange lasted about four minutes during which Ms. Barton and her concerns remained at the center of the conversation.

Example 8.5:

1	Facilitator:	[To Ms. Barton] So do you want to talk a little bit about yours?
2	Ms. Barton:	Yeah. My ah, research is about, um, using revoicing, creating, and um, inviting to um [2 sec] see if that creates a productive and powerful whole group instruction. And I wanted ninety-percent of that whole group instruction to be from student to student, so those discourse moves, um, help to create that. And I video taped, I have actually three tapes from this year. I only have two on my computer. And so I had talked to my focus group about, um, just reminding them, you know, what our goals were for whole group instruction. You know, and I really walked away from that last tape like, "You know these's really lots of great revoicing all the time." We always do that. And then the inviting. But the creating was the part that wasn't working so well.
3	Facilitator:	That's the hardest one. […]
4	Ms. Barton:	MmHmm. And so one kid asked a question, which was interesting. And you can hear me, oh my gosh. It's not even close to a ninety - a nine to one ratio. At all. So…
5	Ms. G.: (6th grade)	And is that a reasonable expectation? Where did you get the nine to one? [Overlapping talk]
6	Facilitator:	She wanted to push herself.
7	Ms. Barton:	I want me to talk less and them to talk more.
8	Facilitator:	And to talk to each other instead of always – So she wants the ping pong thing to stop.
9	Ms. Barton:	And we're not even… So, I was a little bit discouraged by watching it. Because I remember when [student C] asked this great question. But then I have to set everything up. "Alright, C just asked this great question, who wants to respond?" You know, they just don't look like they're like, "Oh, that's a great question. I want to respond." You know? So, it was a lot of Revoicing. There's certainly Inviting because I cold call on them all the time. But it's still about me and them. Instead of about them and them. And I just want to be the referee. You know, "Wait, wait. One at a time now." That's what I want to do.
10	Mr. Hale:	It's early days still.
11	Ms. Barton:	I know. I know. So…
12	Facilitator:	Because last year by the end of the year you had more of them disagreeing with one another and that kind of thing.
13	Ms. Barton:	Yeah. So we just have to go back and revisit the expectations and things. So…
14	Facilitator:	Is there a way that you could get them to signal that they want to disagree with something? […] Sometimes I will actually have

something on the board and then I'll call on someone and then I'll just sit down.

Ms. Barton began by explaining the focus of her research (turn 2). The PD Facilitator regularly asked all study group members to provide summaries like this one were in order remind members of the study group of the context for whatever information they were about to hear.

Through summaries such as turn 2 of Example 8.5 and lines 5-10 of Example 8.4, I observed that participants gained confidence and facility speaking about their research as they repeated their focus over the course of many meetings. As the year progressed participants' descriptions of their research foci became more clear, concise, and declarative, including fewer pauses and more confidence.

For comparison, in the eighth study group session, three months after Example 8.5 occurred, Ms. Barton summarized her research focus as follows:

The data that I collected was from videos, um, and I wanted to be more purposeful in my Inviting and Asking and Creating moves so that would, you know, impact productive and powerful student-to-student discussion.

Ms. Barton's later summary of her research was much more direct than the way she stated her focus on turn 2 of Example 8.5. This is evidence of a broad theme I observed that participants' interactions around data became more confident and adept at describing successes, challenges and defending claims related to data across the year.

Another way that I observed interactions around data for a research audience to be supportive was the explicit suggestions and constructive feedback participants and the PD facilitator provided in response to participants' struggles. For example, in turn 2 of Example 5, Ms. Barton confessed that she was struggling with successfully using a teacher

discourse move (turn 2). In turn 3, the PD Facilitator empathized with Ms. Barton by confirming that the *Creating* move is one of the hardest of the set for teachers to do. Ms. Barton went on to express dismay at how far from her target ratio of nine student turns to one teacher turn. One of the sixth grade teachers in the study group (not a participant of this study) inquired whether such a lofty goal was reasonable. The PD facilitator supported Ms. Barton's explanation for why she would set such a high goal despite the fact that she might never realistically achieve it.

In turn 9, Ms. Barton shared that she felt discouraged by watching a video recording that revealed that despite her efforts to use particular teacher discourse moves more effectively, her classroom discussion still centered primarily on her and not on her students, as she would like. Mr. Hale expressed support by suggesting that it was still early in the school year (turn 10) and change might not yet be apparent. The PD Facilitator added to that expression of support by reminding Ms. Barton of some of the successes she experienced related to her goal at the end of the previous school year (turn 11). Additionally, in turn 14, the PD Facilitator went on to offer ideas for strategies Ms. Barton might try out to help address the issues she was facing.

Interactions Around Data: Teachers' Active Positioning and Expressions of Agency

Participants positioned themselves at the center of their discussions of data and evidence in relation to a research audience. Specifically, participants focused on their actions (e.g., instructional moves, data collection, data analysis). Participants described their reasoning for particular actions and shared what they hoped to learn as a result.

Example 8.6, an excerpt from the seventh study group session (January) illustrates this theme. In Example 8.6, Ms. Pell described her action research efforts in the month after

returning to fulltime teaching following her maternity leave. She explained that she began

by examining student work samples to establish a baseline for how students wrote about

their mathematical solutions.

Example 8.6:

```
 1   So, I am looking at how a group summary affects what students are writing and
 2   understanding. So, I just have baseline data because I haven't done much. And some
 3   of this, I didn't even teach. And I started sorting into piles because I was going to
 4   pick specific students, but then I talked to [Mr. Hale]. He was like, "Last time with
 5   [PD Facilitator] she helped me like kind of organize them into like just groups of
 6   types" And so I started with that with a couple of different assignments. And the
 7   thing that really caught my attention when I sorted them was that it was really
 8   similar to our Conceptions of Math Inventory last year. [...] So, I think I want to give
 9   this class that I looked at the Conceptions of Math with their names on it, so I could
10   actually show that with the data - if that's matching what I'm seeing in their writing.
```

Ms. Pell described sorting through student work samples. She explained that she used a

method Mr. Hale described learning in an earlier study group session to categorize the

samples into representative groups, rather than focus on individual work samples. She

went on to explain that she recognized patterns in the student work similar to those she

observed in data she collected during the previous year from a survey designed to capture

students' beliefs about mathematics. Building from those observations, Ms. Pell explained

her plan to use the same survey again in order to more accurately compare those results to

her observations of students' writing.

   Example 8.6 is characteristic of the ways participants actively positioned teachers in

discussions about data use for research. In particular, Ms. Pell described what data she

collected, her process for analyzing that data, and the next steps she would like to take

based on what she interpreted from the data. Throughout the example, Ms. Pell

consistently used action verbs, such as sort (line 4), talk (line 5), start (line 7), and give

(line 11). Ms. Pell framed her processes of data use (i.e., noticing, interpreting, constructing

implications) in terms of actions she was taking. At no time in Example 8.6 did Ms. Pell

reference things being done to her or for her. This is illustrative of the ways participants

discussed their work as researchers; they positioned themselves as active decision-makers

and described the steps they took to move forward their research efforts.

Relatedly, I observed participants express agency throughout the majority of their

discussions of using data for a research audience. Specifically, participants described ways

in which they assumed control over challenging situations (e.g., improving instructional

practices, interpreting data).

Example 8.7, an excerpt from Mr. Hale's third interview, highlights this theme.

Leading up to Example 8.7, Mr. Hale explained how he analyzed student written work by

looking for themes or comparisons across a whole class of students. He went on to explain

that examining the different ways students explained their understanding allowed him to

get a sense of what he as the teacher had done "right or wrong" during a particular class.

Example 7 is the excerpt of the interview that followed in which Mr. Hale discussed his

perspective on his efforts to improve classroom instruction.

Example 8.7:

1	Mr. Hale:	And then the second piece that's been interesting about this whole
2		discourse thing is, how do we connect what we did to what they came
3		up with. I think in the past it was always just what did the kids learn?
4		Well, what's our role in that, right? And that's a difference in how we
5		think about education. It's always been instructional practice have an
6		impact and blah, blah, blah, but what kind of data do we have about
7		our practice that impacts the data we have about what they've
8		learned? And that's how I see some power within the discourse. [...]
9		So, am I using teacher discourse moves? How am I using them? When
10		am I using them? And that data is almost all qualitative. I mean I can
11		count, I guess, how many times I ask a probing question. "Six-hundred

12		and four." [sarcastically] Yay.
13	Cavanna:	Yeah.
14	Mr. Hale:	That doesn't tell me a lot unless I know some other things about it. I
15		*think it all comes back to how do we impact what we can control? What*
16		*we can control is the instructional practices and we hope that impacts*
17		*students' learning.* And how we can best make it impact student
18		learning. [Emphasis added]

Mr. Hale explained that participating in the study group and professional development focused on mathematics classroom discourse ("this whole discourse thing") supported him to consider data he had about his classroom practices as a means to examine the impacts his teaching had on students. Specifically, he noted that he has control over his own instructional moves. Thus, he could consider data about the ways he used particular teacher discourse moves in order to shape his instruction to improve students' experiences.

Example 8.7 is illustrative of the ways participants expressed agency as a part of their data use for a research audience. Data for research provided participants with opportunities to examine connections between their teaching moves and outcomes for students. Repeatedly, throughout interviews and study group sessions, when participants discussed using data for action research, they described themselves and other teachers as active agents in the process. They expressed agency for both the work of researching (e.g., deciding what and how to collect particular data) and the work of instructional change (e.g., intentionally shifting instructional practices to improve a particular outcome for students).

Implications and Uses of Data: Using Evidence to Support Claims

Participants used data about their instruction and students as evidence to support claims they made about what they observed through their action research efforts. Over the

course of the year, I observed a shift in participants' use of evidence. Specifically, early on, participants made claims through comparisons to their prior teaching experiences or their knowledge of what their students have "typically" done. Towards the end of the year, however, participants began to support their claims with richer, qualitative descriptions of specific evidence.

In both interview and study group settings participants made a variety of claims about their students or their instruction. Often the PD Facilitator or I prompted participants to make such claims, and often participants struggled to make claims they felt they could clearly support. For example, in her second interview Ms. Barton made a claim that students' performance was improving. She said

> I can't say this is specifically related to my research focus or not, but I can say I can look at student trends from – using the very same assessment on the two to three year period how much more students understand or at least demonstrate that they understand about concepts than they had traditionally.

Ms. Barton described her observation that her current students demonstrated a better understanding of particular mathematics concepts than her students typically had in the past. She did not refer to specific data she had collected, but rather she drew on evidence from her many years of experiences teaching the same content to make a comparison. This kind of comparison, one that used personal experiences, was typical among the participants. Despite the fact that none of their action research projects involved control groups or experimental designs, many of the early claims teachers made described comparisons to past experiences.

Another illustration of the ways that participants used comparisons as a part of their early claims is Example 8.8, an excerpt from Mr. Hale's second interview. Mr. Hale recounted a claim he struggled to make during the preceding study group session. Prior to the excerpt in Example 8.8, Mr. Hale explained how the PD Facilitator pressed him to justify his claims and he struggled a bit to say what he meant.

Example 8.8:

1 And it really came down to revoicing pieces. Um. And so that the claim I made - and I
2 don't have it in front of me word for word or anything - so this is memory,
3 paraphrased. Um. But what I did was I took some pictures of some whiteboards and
4 some work that they did and I took a few of those and presented them up. I sent the
5 pictures to my email and then I projected them so they were on the screen. And um,
6 I asked them to either reword or explain the thinking involved in their response
7 written on the whiteboard. And so I treated that as their revoicing. And what I saw
8 was some really interesting connections that I don't think I would've gotten
9 otherwise. *So, my claim was that the - the ability to revoice, you know using the*
10 *revoicing idea, showed a depth... um a little bit better depth of understanding and the*
11 *ability to show their understanding in more than one way.* Because I asked them to
12 take some words and turn it into pictures, you know, do different things with it. [...]
13 *So, I think that to - by asking them to revoice and either explain or question or draw or*
14 *whatever, showed better understanding based on the revoicing than I would've seen*
15 *otherwise.* That's more or less what I think that I said. [Emphasis added]

Mr. Hale began by describing an activity in which he asked students to reword or explain their classmates' photographed responses to a particular mathematics task. He explained that this activity supported students to engage in revoicing. Specifically, he used this lesson as an instantiation of the teacher discourse move *Asking students to revoice* (line 9). Mr. Hale claimed, that students were better able to show their understand through this activity than they would have been able to if he had not provided the opportunity for them to revoice. This comparison implicitly drew on Mr. Hale's experience working with students on the same mathematical content, but using different instructional methods.

Nearly all of the claims participants made about students or their instruction involved comparisons. More of those from the first half of the year made comparisons based on historical evidence or experience. In contrast, later in the year, participants made claims that included richer, qualitative descriptions of specific evidence. Example 8.9 is characteristic of the ways participants supported their claims towards the end of the year. Example 8.9 is an excerpt from Ms. Barton's final interview. She is responding to a question that asked her what claims she could make about students or her instruction.

Example 8.9:

1	Ms. Barton:	One claim I feel like I can make is that as a result of our discourse
2		work, the teacher discourse moves and this three-year training that
3		we've been a part of… I think it has made classroom instruction,
4		classroom culture, student engagement, the interaction between
5		students, and how they seem themselves as math thinkers and doers. I
6		think it has improved all of that.
7	Cavanna:	Mmmm.
8	Ms. Barton:	It has taken the focus off of me, as an instructor, and put the focus
9		on the actual learning for individual students. And I think they're
10		empowered by realizing they have a lot of control over their learning.
11		And it doesn't have to look a certain way. And they can investigate
12		what kind of a learner they are. You know, modify and tweak that,
13		y'know shape that… and feel good about it. And take that to the next
14		level, to the next course.
15	Cavanna:	Yeah. And what have you seen that has led you to feel like you can
16		make that claim?
17	Ms. Barton:	What I - Student are - I don't really have to ask them, or to interact
18		with someone else. I just merely have to say "This is our activity. This
19		is the expectation." They do it. We don't have conversations about, "I
20		don't want to work with that person. I just want to work by myself."
21		You know I don't have conversation, or I don't see students just sitting
22		and not doing. Oftentimes when we are in a more focused discussion, I
23		see students interacting with the thinking because they're, they're
24		wanting to get to it, so they remove themselves from the whole
25		group… so it has just become a part of their practice. I see them so
26		willing to participate. And the percentage of students, even those
27		more introverted ones actually participating in small group has
28		improved. Um. And when you look at the videos, you can see them

29		working with their partner, and some of the language... you know
30		there are some kids I wonder what they're voice sounds like. But I get
31		to hear it in their discussions with their table partner. So those are the
32		kinds of things that I see that make me think that these are the big
33		changes that are resulting from the discourse work.
34	Cavanna:	Mmmm.
35	Ms. Barton:	And I can stand in the back of the room and just say so much less and
36		then they just take it away and they don't have to ask why... too much
37		more, because they'll say something and they'll substantiate it with
38		their thinking.
39	Cavanna:	Mmmm.
40	Ms. Barton:	And they'll do that in their writing more than they have in the past,
41		because that has been a problem. Your thinking needs to be visible, so
42		how, whatever mode whether you're writing or you're speaking, your
43		thinking has to be visible. And so because they practice it so much
44		verbally it's easier for them to do it in the written form, which they're
45		really, you know, they push back a lot about that.

Ms. Barton explained that her efforts to improve her practice through her participation in the PD over the past three years and her efforts to use specific teacher discourse moves helped to improve her "classroom culture, student engagement, the interactions between students, and how they [saw] themselves as math thinkers and doers" (lines 1-6). Ms. Barton went on to describe the changes she has seen in her students' participation using specific evidence from her classroom. For example, she described seeing an increased percentage of students participating during small group interactions and hearing even introverted students discuss mathematics with their partners (lines 26-31).

Timescale for Data Use: Looked for Patterns Over Time

Participants used data over both shorter and longer timescales for a research audience. In particular, they looked at shorter timescale data as they continually tried to make changes to their instruction in pursuit of their action research goals. Participants also

looked back at the data they collected across the year to explore patterns in their instruction, student participation, and/or student learning.

For example, in my second interview with Ms. Jackson she described her reactions to watching some of the video recordings she had made of her classroom. She said,

> I just watched my videos for the first time, you know, just a couple of weeks ago. So, I really haven't seen what has been going on in my class. I just see from the teacher's front-of-the-room perspective. And watching the video is kind of making me reconsider what I need to be doing in my classroom. So, I hope to see that, you know, over our next session of watching the videos that I will see a little bit more improvement.

Here Ms. Jackson described her reactions after examining video data she had collected for her action research for the first time. She acknowledged that watching the video recordings encouraged her to change her instruction because the recordings helped her to see her classroom from the students' perspective. She realized that things were not going as well as she thought.

The timescale of Ms. Jackson's data use is characteristic of how all of the participants used data for a research audience. Specifically, Ms. Jackson had collected video recordings over weeks and months. Then, when she took the time to analyze the data she had collected, she made both short-term and long-term plans. On a short timescale, she intended to make changes to her instruction right away. She also continued to record videos of her classroom over the weeks until the next study group session. At that point, she would look back at the data she collected to see her progress.

Later in the year, participants intentionally looked across all of the data they had collected in order to identify broader patterns. For example, for Ms. Jackson, this process involved analyzing video recordings from September through June. Describing the patterns she noticed across her data she explained,

> I can see the progression, you know, with a couple of dips where I had maybe a bad day or the kids had a bad day. I can see a progression of more tally marks in the productive discussions for the kids. More tally marks for me using discourse moves. So, I definitely see kind of an upward trend of both of those as we progress through the year.

Ms. Jackson described examining her analysis of her video recordings across the year of data. As a part of her analysis, Ms. Jackson created charts in which she recorded tallies for the number and type of teacher discourse moves she used as well as which students participated the quality of that participation. Looking back over the year worth of data, Ms. Jackson explained that she observed an increase in her use of teacher discourse moves as well as an increase in the number and quality of student contributions to class discussions.

As a part of their action research, all of the participants collected and analyzed data repeatedly throughout the school year. Then, towards the end of the year, participants were able to look back across all of the data they collected in order to examine patterns across a longer timescale. This kind of data use that involved looking at patterns over time could have been possible with the data teachers had access to from the data management warehouse software, Illuminate Ed, but it was only in the context of doing research that I observed participants discuss patterns in data over time.

CHAPTER 9: DISCUSSION, IMPLICATIONS, AND LESSONS LEARNED

Coburn and Turner's (2011) framework for data use encompasses many factors tied to data use, including interventions to promote data use, organizational and political contexts, data use processes, and potential outcomes of data use. Using this framework as a guide, I also address a number of issues related to teachers' data use in this chapter. I begin with a brief summary of the findings of this study. I then discuss what it means for teachers to use data in practice and how that is similar or different from being "data-driven." Then, I discuss the role action research played in this study as an intervention to promote data use. I subsequently describe the theoretical contributions of this study, including considerations of the timescale for data use and how agency factors into Coburn and Turner's framework for data use. Additionally, I address the outcomes of data use I observed in this study and I discuss implications and future research. Finally, I conclude this study by describing what I, as a beginning researcher, learned about conducting research in schools.

Summary of Findings

This study closely examined the ways a small group of mathematics teachers used and discussed data and evidence in practice as classroom teachers and as teacher action researchers. Through interviews and observations, I explored *what* data teachers used and *how* they described using those data. I also considered the influences of policies and initiatives and issues of teachers' agency on the ways teachers discussed data use.

Using some narrative discourse analysis techniques, I found that participants used different data and in different ways related to the audiences with whom they interacted. Specifically, the ways in which teachers used data and evidence were different when they interacted with other stakeholders, teachers, and researchers. I observed differences in

teachers': (a) noticing data, (b) interactions around data, (c) implications and uses of data, and (d) timescale for data use. Additionally, using a lens of ecological agency, I observed that teachers expressed more agency when they used data for teaching and research than they did when they used data with and for other stakeholders.

Reconsidering Definitions: What Does *Data* Mean in Schools?

These findings add to a growing set of research that emphasizes the complex and interpretive nature of what it means for teachers to use data in practice (e.g., Coburn & Yamashita, 2009; Daly, 2012; Spillane, 2012). Understandings about the meaning of data are not uniform across individuals. Many current educational policies on data use require teachers to use data as a central component of accountability measures, but provide only limited or implicit criteria for what it means to do so (Jennings, 2012; Roderick, 2012). Without a clear understanding of what it means to use data, one cannot assume data use is a valid means for improving education for students. Likewise, it is unfair to evaluate teachers on whether or not they met expectations for using data if they lack a shared understanding of what data use means. Thus, there is an immediate need for explicit and critical discussions around what it means to use data and how that meaning may be nuanced in relation to teachers' action in classrooms and policy expectations

Discrepancies between how administrators and teachers at Jefferson Middle School described data provide evidence that the meaning of *data* requires explicit discussion in schools, especially as it relates to evaluation measures. Despite the focus of school and district evaluation policies on teacher-assigned grades as measures of student learning, both Dr. Trainer (district level) and Principal Martin (school level) expressed understandings of *data* that incorporated teachers' formative assessments and an

examination of a range of information about what students knew and could do. These understandings matched surprisingly well with how participants used data in practice in their classrooms and as teacher researchers.

Although administrators and participants shared similar personal understandings of data, interactions between participants and administrators did not reflect these similarities. In particular, participants almost exclusively provided grades and assessment scores to administrators, following lockstep with established teacher evaluation requirements. They provided these data despite the fact that they did not find them particularly informative with regards to students' understanding or to changing their teaching practices. Since participants simply handed over their numeric scores and grades, their interactions around data with administrators were short, without much conversation around ideas or implications for the meaning of data.

There were no explicit discussions between teachers and administrators about what it meant to use data and evidence at Jefferson Middle School or more broadly within the Greenville School District. Consequently, teachers and administrators did not have opportunities to compare their understandings of data and data use. Explicit conversations about what *data* are and what it means to *use data* offer learning opportunities for both administrators and teachers that could enrich their interactions around data.

Additionally, considering the potential consequences of teacher evaluations, it is vital for all parties to have a clear understanding of the expectations of using data to ensure transparency and parity in the system. Specifically, teacher evaluation had the potential to dramatically impact participants' lives because important decisions, including those related to hiring and layoffs were tied to those scores. Since a significant portion of teacher

evaluation was based on data that measured student learning, it follows that there should

be consensus on what data best measure student learning. My findings reveal, however,

that the implicit definitions of data established by DDDM initiatives and teacher evaluation

policies did not fit with the ways administrators and teachers conceived of data as most

informative of student learning. Without any explicit conversations about data, participants

followed the implicit messages they interpreted from the state, district and school,

providing the data they thought administrators wanted. Those data used for evaluation,

however, did not match with how participants or administrators described data

informative for student learning. For example, both participants and administrators

identified student work samples as particularly informative of student learning, but only

students' course grades and semester assessment scores contributed to evaluations. Thus,

due to a lack of transparency in the evaluation system, critical teacher evaluations were

conducted using less informative data. For there to be parity in a teacher evaluation

system, both those individuals being evaluated and those doing the evaluating must have a

clear, shared understanding of what data are valued in that situation and how that data

should be used.

Reconsidering Definitions: Unpacking "Data-Driven"

There is a need to examine the practical meanings and applications of the concept of

being *data-driven*. The term "data-driven," central to the data-driven decision-making

(DDDM) paradigm implies that a practitioner moves meaningfully from a piece of data to a

particular action. The use of the term "driven" emphasizes this connotation because it

suggests both a motivation to change and a specific direction for such change. We know,

however, that using data inherently requires interpretation (e.g., Datnow, 2012; Mandinach

et al., 2006). Furthermore, there are variations in the ways teachers understand the meanings and uses of "data." With these additional considerations, the term "data-driven," a term that may presume a single path to specific actions, loses some of its meaning. Teachers' data use is shaped by what they want to learn from the data and with whom they are sharing information. Thus, there is much more to data use than being "data-driven."

To illustrate the contrast between teachers' thoughtful data use, presented in these findings, as compared to the ways DDDM models have been discussed in public discourse, consider the following statement from former Secretary of Education, Arne Duncan. The excerpt was taken from Duncan's (2009) address at the Fourth Annual IES (Institute of Education Sciences) Research Conference, in which he spoke to an audience of experienced researchers. Duncan described a variety of benefits of incorporating systematic data use into all elements of school practice. Lauding the impacts of the national Race to the Top initiative on classrooms, Duncan stated,

> Many teachers are hungering for data to inform what they do. Our best teachers today are using real–time data in ways that would have been unimaginable just five years ago. They need to know how well their students are performing. *They want to know exactly what they need to do to teach and how to teach. It makes their job easier and ultimately much more rewarding.* They aren't guessing or talking in generalities anymore. [emphasis added]

In this excerpt Duncan identified a perennial problem of teaching — it is extremely difficult to know how to improve instruction in ways that support greater student learning. Teachers want solutions to this problem. Duncan's rhetoric also highlights that "data" has been portrayed as an unassailable answer to the problem of what and how to teach.

Nowhere in Duncan's comments, however, did he discuss the role played by analyzing, interpreting, or criticizing data. Instead, he included statements like those italicized above, which imply that data might be the factor that actually tells teachers "what they need to do to teach and how to teach." This is just one example of the ways in which DDDM models and the idea of teachers being "data-driven" have been taken up by policy-makers.

The findings of this study illustrate the ways in which the work of using data in classrooms is more complex than the ways policymakers talk about DDDM models. In education, there must be space for teachers to reinterpret what they notice and to question what the try to put in action. The space for critical reflection can easily be missed when DDDM models are adopted.

Action Research as an Intervention to Promote Data Use

As an alternative to a *data-driven* model, these findings show how an action research model supported teachers' dynamic understandings of data that reflected the complexity of using data in practice in schools. Action research served as an intervention to promote data use that generated instructional changes via teachers' critical interpretations of data they identified as meaningful to their own classrooms.

By the nature of its design, with teachers at the center of the research, the action research study group addressed many of the challenges identified by research on data-use interventions (e.g., Marsh, 2012; Mason, 2002). In particular, Marsh's (2012) review identified persistent challenges across school districts using data (even those identified as "high-data-using"), including difficulty maintaining a depth of support for teachers over time and across the different processes of data use. For example, many districts provided support for teachers related to accessing data, but teachers often lacked supports related to

analyzing data, identifying its implications, and using data to change instructional practices (e.g., Goertz et al., 2009; Means, 2010). Additionally, Marsh (2012) identified a need for more interventions that supported teachers to bridge from using data to making corresponding changes in instruction based on that data.

I found that teachers took ownership over all of the data use processes (e.g., noticing, collecting, interpreting) in their action research work. Additionally, teachers took action as a part of their research efforts to make targeted changes to their instruction. Through their interactions with other teachers and researchers, teachers also demonstrated their individual teacher agency for such change.

This study focused on a small group of dedicated teachers working closely with a university facilitator in a multi-year partnership. In contrast, the interventions reviewed by Marsh (2012) were, by design, large, multi-district projects that involved many teachers and administrators. Since action research requires considerable investment on the part of individual teachers and the action research model prioritizes the interests of the teacher researcher, it is unlikely that an action research intervention could be mandated across multiple districts. Instead, these findings suggest that a possible model worth investigating would be to engage a network of committed teacher researchers to support one another across all steps of the action research process.

Given the widespread calls for using data in schools, additional research is warranted into how an action research model as intervention for data use could be scaled up in ways that honor the professionalism of teachers. Specifically, action research could offer an alternative to *bureaucratic* mandates and accountability evaluations for teachers, a

teacher-centered, *knowledge-based* alternative that more accurately captures the variability of using data in practice in schools (Darling-Hammond, 1990).

Significance of Mathematics Teachers Data Use

Although this study does not present evidence to compare the data use of mathematics teachers versus other teachers, I posit that the fact that these were mathematics teachers matters. Specifically, the focus on secondary mathematics teachers, as compared to teachers of another subject, offers particular insights into data use. Since these participants were secondary mathematics with considerable preparation and knowledge in mathematics, they had the quantitative reasoning skills to make sense of data presented in the form of numeric tables, charts and graphs. That is, if presented with quantitative data about student achievement (e.g., data reports from Illuminate Ed), secondary mathematics teachers are well positioned to make sense of that information. If the participants of this study did not make use of quantitative data, it is likely not because they did not understand it. Instead, it is more likely that there were other factors at play influencing mathematics teachers' data use. Further research is warranted into the data use practices of: (a) a broader sample of secondary mathematics teachers and (b) teachers of other subjects.

Relatedly, it is also notable that these secondary mathematics teachers found qualitative data as informative as they did. Since the participants did have a background in mathematics, I expected them to have been more inclined to value mathematical representations of information, such as quantitative data and graphs. In contrast to my expectations, all of the teachers described the value of qualitative data, including student discussion and classroom videos. The fact that the findings reported here describe the data

use practices of secondary mathematics underscores the value of qualitative data for improving instruction, even for teachers who have the background knowledge and experience to use quantitative data.

Timescales for Data Use and Formative Assessment

These findings suggest that the timescale for data use may be a complicating factor in shaping how teachers use data and whether or not their data use informs instruction. I observed that teachers regularly used student assessments as data sources to inform instruction and track student progress. In particular, for a teacher audience, teachers primarily focused on data over a short timescale, interpreting assessments and interactions with students daily to make decisions about their teaching.

Linking with prior educational research, these uses of data can be described as *formative*. Black & Wiliam, (2009) define formative assessment in the following way,

> Practice in a classroom is formative to the extent that evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers, to make decisions about the next steps in instruction that are likely to be better, or better founded, than the decisions they would have taken in the absence of the evidence that was elicited (p. 9).

This definition connects data about student achievement to teachers' next steps in instruction. Such a link between data and action is one the persistent challenges of promoting data use identified by Marsh (2012). Black and Wiliam's (2009) definition is important to this study because if data are only considered formative when it influences the "next steps in instruction," then the timescale for using that data is necessarily quite short. Formatively using data requires noticing, interpreting, constructing implications, and

acting on that data all before taking any next steps in instruction. In fact, research indicates that only formative assessments used over short (5 seconds to 48 hours) and medium length (within and between instructional units) times cycles improved student achievement (Wiliam, 2007).

I observed that teachers used data differently over a longer timescale. For an audience of other stakeholders, teachers utilized data across a long timescale to make post hoc rationalizations or justifications for their decisions. For example, in the context of teacher evaluations, teachers did not indicate engaging in much reflection, but rather intentionally selected long timescale data (e.g., test scores) as evidence to back up the decisions they already made. Consequently, the long timescale data used as a part of evaluations did not prompt changes in instruction. If administrators intended for teacher evaluations to support teachers to reflect on their instruction and to subsequently improve their teaching as a result, then, these findings indicate there may be dissonance between intended uses of long timescale data and the ways teachers use it in practice.

It is possible that future longitudinal research might find that data used over a long timescale can support teachers to think globally about their instruction. These findings revealed, however, that when teachers used data on a shorter timescale, particularly in collaboration with other teachers, they were able to analyze that data and construct implications in ways that supported them to continually adjust their instruction. Thus, in addition to considering the characteristics of the assessments that influence the value of data for teachers (e.g., Supovitz, 2012), this study links research on formative assessment and data use to add timescale as another important variable to consider when evaluating the potential impact of data use on instruction.

Interestingly, the action research study group supported both short and longer timescale data use. Thus, teachers might benefit from that type of intervention to promote data use in meaningful ways over a longer timescale. Specifically, in the action research context, teachers used data formatively and also examined patterns across the school year. Working through the action research process, teachers noticed and interpreted data about their instruction and students' learning and participation. They made adjustments to their instruction based on what they learned. Additionally, during study group meetings with a skilled facilitator and their colleagues, teachers critically examined their research findings to make decisions about areas where they were having success and where they needed more work to achieve their goals.

Additionally, these findings support prior research that video recordings can be a powerful aid to teacher reflection (e.g., Sherin & van Es, 2005; 2009; Tripp & Rich, 2012). Although they were initially hesitant about collecting video data, in part because of the real and perceived difficulties of collecting and analyzing video, all of the teachers in this study described how informative they found video recordings to be. In particular, video recordings provided opportunities for teachers to identify what Hopkins (2002) called a "performance gap" or discord between what they observed in their video-recorded performance and their goals or intentions. Watching the videos supported teachers to see their classrooms in a new light; they were able to examine their own developing skills as teachers and consider unexpected events as they learned more about their students (Cavanna, Herbel-Eisenmann, & Seah, 2015). Although video data are not typically considered part of the cannon of formative assessments, I argue that video recordings can offer an important data set for teachers to formatively assess their teaching practice.

**The Importance of Agency: Amending the Framework for Data Use**

In the current political and social climate, external forces such as market-based, neoliberal reforms are often realized through accountability measures and increasingly govern schools (Anderson & Cohen, 2015). Data and scientific evidence are the currency of these efforts, of which DDDM is an example. Subsequently, teachers are positioned as disembodied "factors" to improve the "efficiency" and "performance" of schools with little attention to teachers' professional knowledge or judgment (e.g., Biesta, 2015; Keddie, Mills, & Pendergast, 2011). At a time when, globally, educational experiences are becoming more privatized, highly scripted, and outcome driven (e.g., Anderson & Herr, 2015), I argue that issues of power are continually relevant. In particular, power issues are prevalent across all aspects of data use and it is essential to consider teachers' agency as a central component of their data use practices. Therefore, using an ecological perspective of agency (Biesta & Tedder, 2007), I posit that understanding data use requires attention to the degree to which teachers are in control of their responses to data they create, receive, and/or use.

For example, whether or not a teacher changes her instruction based on their interpretation a sample of student work depends not only on the influences of her organizational and political context to which the teacher is subject, but also whether or not that teacher has agency. By having agency, I mean, in addition to influences exterior to the teacher, does the teacher perceive she has control of a situation such that she has the power to take action?

Coburn and Turner's (2011) framework for data use includes "power issues" as a single bullet point under the larger heading of Organizational and Political Contexts. Instead of a single bullet within a sphere of larger contexts, power can be a lens for

130

understanding the entire data use framework. I argue that teacher agency — teachers'

professional judgment and capacity to act — provides a means to examine the ways in

which teachers relate to broader systems of power influencing data use in schools.

These findings reveal that teachers' expressions of agency varied in relation to the

audience of their data use. Teachers' expressions of agency ranged from robust and in

control when they interacted with other teachers to limited and passive when they

interacted with other stakeholders. Figure 9.1 illustrates a possible amendment to the

Coburn and Turner (2011) framework to help better reflect the realities of using data in

practice.
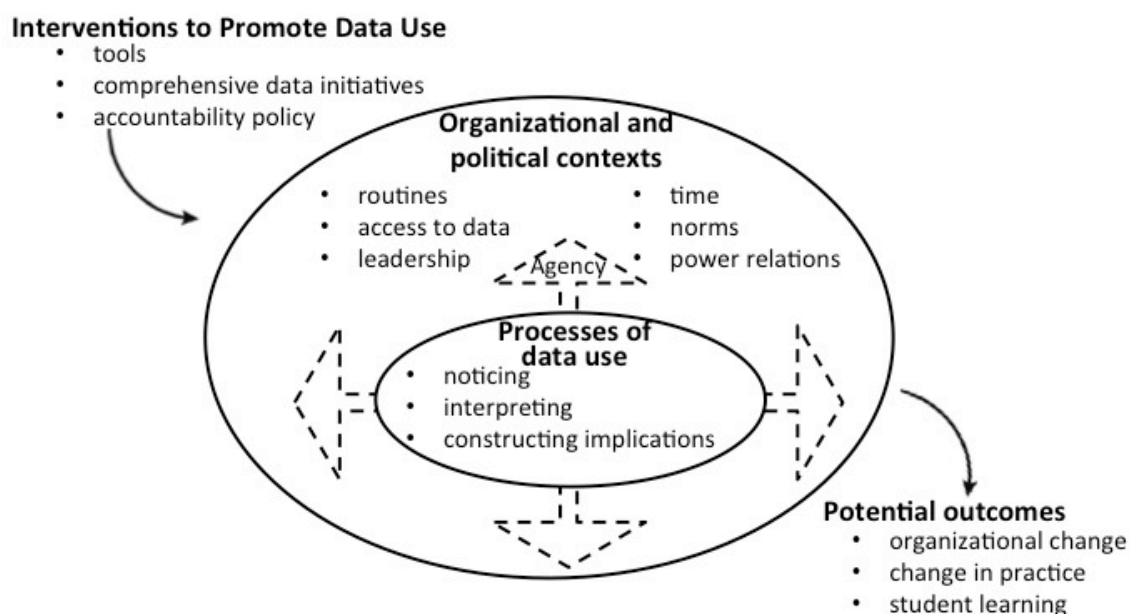
Figure 9.1. Modified Framework For Data Use to Include Agency

Unlike the original framework, this modified version includes agency as a mediating factor

that influences data use. In figure 9.1, arrows marked "agency" radiate out from the

processes of data use region. The arrows have dashed outlines to represent the

permeability of whether of not individuals express their agency in various circumstances.

131

The addition of agency helps to fill in a missing detail of the framework. Individuals engaged in the processes of data use may or may not take action towards outcomes based on whether or not they feel they have control or agency to act in their situation.

Potential Outcomes and Future Research

Coburn and Turner's (2011) framework identified three categories of potential outcomes of data use: organizational change, change in practice, and student learning. These findings illuminate how teachers described changes in their teaching practices as well as changes in the data use practices. Specifically, teachers used enhanced and varied formative assessments that provided them with richer insights into what their students knew and could do. Teachers also reported increased student learning and participation as outcomes of their action research efforts, but this study did not measure or characterize outcomes for students. Future investigation into how teachers' data use impacts student learning is needed. In particular, partnering with teachers engaged in action research might provide a rich site for such research due to the close connection between data use and change central to the action research paradigm.

Since teachers interact most directly and consistently with students, they have a unique perspective to add to conversations among administrators and policy-makers regarding the data and evidence that are most informative for changing classroom practice. Sharing action research findings may be one way to support such interactions between teachers and other stakeholders. Teachers will likely need support for using evidence to support their claims for broader audiences. In interactions with other teachers, the use of comparisons to historical teaching experiences served as meaningful evidence of change. In policy conversations with outside authorities, however, teachers will need to support their

claims in ways that fit the expectations of those audiences. Therefore, to support teachers to have a stronger voice in educational decisions being made about their classrooms, teacher educators should investigate ways to help teachers to use evidence in ways valued by outsiders. Conversely, teacher educators and educational researchers can learn from the ways teachers use evidence with teacher audiences to better understand how educational change is characterized by insiders. By contributing to an understanding of how teachers use and make sense of data and evidence, this research offers links between the fields of teacher education research and educational policy. Future supports for teachers to use data in ways that are systematic and authentic offer a pathway to improve mathematics instruction for students.

Lessons Learned

As a new researcher, this study provided me many opportunities to learn. In this section I reflect on what I learned about mathematics education research that applies to my future work in the field as a researcher and teacher educator. In particular, I discuss lessons I learned (a) about engaging in and writing about research and (b) supporting teachers to use data.

The most prevalent lesson I learned from engaging in this study is that it is difficult to accurately capture the complex web of factors that influence work in classrooms in public schools. I went into this research knowing that teachers work within a multifaceted environment that is influenced by a range of social, cultural, and political factors. Trying to examine and describe that environment, however, was more difficult than I anticipated. In particular, I found it challenging to systematically investigate factors that tacitly influence teachers' understandings of data and data use.

I recall learning an adage about a fish describing the water in which it swims as an enduring challenge of qualitative research. This metaphor felt particularly apt as I investigated how state, district, and school policies and initiatives may have influenced participants. Without any explicit definitions or conversations about data to start from, I felt a little like I was grasping at slippery fish and invisible water. I realized that, like many other issues, the language of data and evaluation has subtly permeated discourse about education and teaching and stands generally unquestioned. In the future I hope to continue to interrogate how these issues are tacitly and explicitly affecting teachers and students.

Another lesson I learned was related to maintaining many responsibilities in the midst of designing and conducting research. At the outset of the dissertation study a year of data collection and subsequent analysis and write up seemed like a considerable, but doable, challenge. Due to some personal life circumstances, including moving halfway across the country and having a baby, my plans for how I would complete my research were significantly disrupted. I was forced to learn to manage my research under new circumstances and additional time constraints. I found motivation from a saying from a popular fitness program, P-90X. During the hardest workout sections, the lead coach in video the program often shouts, "You can do anything for 30 seconds!" This philosophy of persevering through challenging work for short bursts helped me to accomplish my research goals under changing conditions. I learned the value of breaking a large research project into small pieces and regularly chipping away at one piece at a time. I expect that these skills will continue play an important role in my future work as a mathematics education researcher as I learn to balance research, teaching, and service with home life.

I also learned about my role as a mathematics educator in supporting teachers in data use and action research efforts. First, I learned that it is important for teachers and researchers alike to ask research questions that matter to them. It is difficult to sustain focus on research amid the regular pressures of teaching, including planning for lessons and evaluating assignments. In order for teachers to make time for tasks such as data collection and analysis, it helps if the research is pertinent and valuable to the teacher. Over the course of this study I learned that it was important for participants and the PD facilitator to remain flexible and open to new ideas related to shifting research foci.

Second, my understanding of the importance of collaborative and collegial relationships was reinforced. I had the privilege of working with the participants of this study for three full years as a part of a larger professional development project. Over the course of that time, I came to see how vital it was to build relationships among teachers and between teachers and university researchers that center on trust and support. Many times over the course of this study participants confessed that they would not have continued their action research efforts or their focused commitment on improving their classroom discourse without the unflagging support of their colleagues and the professional development facilitator. These types of sustained relationships are rare in our current educational system. In the future, I hope to stay in contact with these dedicated professionals and to develop similar partnerships with local practitioners wherever I work.

APPENDIX

APPENDIX: SAMPLE SEMI-STRUCTURED DATA USE INTERVIEW PROTOCOL

I. Organizational and political context: routines, access to data, leadership, time, norms, power relations

1. Describe your typical routines for considering student progress.

2. If you wanted information about a particular student how would you access that information?

3. When I say the word "data," what comes to mind for you?

    a. When I use the word "data" I mean multiple things. Data could be district level information or school-level information about students, families, etc., or it could be information you could gather informally in a classroom. I am intentionally using the word data because it is currently a hot-button word, but I think of it as being a broad term that can be interpreted in multiple ways. How does this broad way of talking data fit or not with how you understand the term?

4. What sorts of data about students do you as a mathematics teacher have access to?

5. How do you keep track of data about students that you, yourself, have collected?

6. Who, if anyone, provides leadership or support for teachers using data about students?

    a. <u>Probe</u>: What sorts of supports do they provide?

7. How much time do you typically spend during a school week thinking about data about students in your classes?

8. What expectations have been established regarding they types of data that are important to consider?

a. <u>Probe:</u> How have those expectations been communicated to you?

9. When an administrator asks you to provide evidence of student learning, what kind of information do you share?

   a. <u>Probe:</u> How might what you share be similar or different if you were talking with another teacher?

II. Process of data use: noticing, interpreting, constructing implications

1. Last year you spent time collecting student work or watching videos of yourself teaching. What kinds of things did you notice or pay attention to when you examined those artifacts?

2. How did you decide among the things that you collected or looked at what mattered or what important?

   a. <u>Probe:</u> How did you interpret what you collected or watched? What did you do to make sense of that information?

III. Outcomes of data use: organizational change, change in practice, student learning

3. What sorts of things did you do differently based on the information you gathered? What sorts of things stayed the same?

4. Tell me about a time when your instruction has changed as a result of data you had about students?

   a. What data did you use? How did you use the data?

   b. How did your instruction change?

   c. Was the change in instruction effective? Why or why not?

5. If you suspect a particular thing is happening with students in your class, what kinds of information do you need to convince yourself that it is, in fact, happening? What kinds of information do you need to convince other people of the same?

6. How do teachers in your department think about collecting and using data and evidence? How might this have changed over the past two years?

   a. <u>Probe:</u> Describe any specific changes you have noticed related to how members of your department talk and think about collecting and using data.

IV. Interventions to promote data use: tools, comprehensive data initiatives, accountability

1. Tell me about your experience with learning how to collect and make use of data about a particular student.

   a. <u>Probe:</u> Did you receive any type of supports or other professional development? If so, describe that experience and how it affected what you did?

2. How do data about students influence your views of yourself as a teacher?

3. Describe how data about students factors into your evaluation as a teacher.

4. Tell me about your experience engaging in action research.

   a. What sorts of data do you plan to collect and use as a part of your action research work?

      i. <u>Probe:</u> What is the primary or secondary source? Why?

   b. How did you decide what data would be important to meet your action research goals?

    c.   Describe the role of the action research group in supporting you to consider data about students?

        i.   <u>Probe:</u> What has been the role of the facilitators?

        ii.   <u>Probe:</u> What has been the role of your colleagues?

5.   Recently there have been some new teachers joining your community here at the school. What kinds of things would you tell these teachers about collecting and using data?

    a.   <u>Probe:</u> Why do you think those things are important?

Thank you for talking with me about these ideas. Is there anything else about data that comes to mind that we haven't talked about?

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