Exploring Teachers' Individualization of Instruction Through Using Student Data

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Dedication

This dissertation is dedicated to my lovely daughter, Elif.

Abstract

The purpose of this study was to explore how teachers engaged in data use for instructional decision making. A grounded theory research design was used to analyze interviews of 10 special education teachers. Special education teachers were asked to complete an online survey and were interviewed with questions to reveal their experiences with student data, and what potential barriers and facilitators they face during the data use process. The survey was used to provide informative data on teachers' dispositions toward data use. The theory generated from the data, Theory of Teachers' Data Use Engagement, proposes that teachers' understanding of data, collaboration with others, professional development, resources available, and district wide implementation and tools affect their data use experience. The coding process, the themes generated from codes and the final theory are presented. The discussion provides a comparison between results from this study and previous literature, limitations of the study, and recommendations for future research.

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CHAPTER 1

INTRODUCTION

Educators are expected to use data for a variety of purposes. Assessment data is one kind of data that educators use for many reasons, including evaluating student learning or instructional effectiveness. In special education, assessment data can be used for many purposes including disability identification, reviewing instructional quality, or assessing student progress. One important area in special education in which educators use assessment data is intensification of instruction. Fuchs et al. (2014) defined intensive instruction as intensive educational care provided when students do not benefit from core general education and small group instruction as much as their peers do.

To identify and meet the needs of students who are not benefiting from current instruction, and to tailor the instruction based on their needs, using data is crucial, because teachers need more than intuition or unsystematic intensification practices when it comes to improving student outcomes. Using data for decision-making has become more important at all levels of education (Mandinach, 2012). Data-driven decision making (DDDM) or data-based decision making (DBDM) is described as a systematic way of collecting, organizing, and interpreting data to inform and improve educational practice[1] (Espin et al., 2017; Mandinach, 2012). DBDM can lead teachers to identify

[1] In this dissertation, I use both terms depending on the term used in the research I summarize or refer to. When I refer to data-based decision making, I use the term DBDM.

students who are at risk, determine instructional changes for students who are not making sufficient progress, and decide when to make these changes (Stecker et al., 2005).

The National Center for Intensive Instruction (NCII; 2013) outlined steps for DBDM, including delivering research-based intervention with increased intensity, frequent progress monitoring, administering diagnostic assessments with students who are not making adequate progress, and adapting instruction as needed based on data from progress monitoring and diagnostic assessment. DBDM is a complex process in which each of these steps requires teachers to have knowledge and skills in many areas. Even though NCII's suggested DBDM steps start from delivering research-based intervention and progress monitoring, for teachers, other prerequisites should be considered, such as teachers' preparedness to understand and interpret graphs, or teachers' beliefs about collecting progress monitoring data and using it within their instructional routines, or the school culture in which teacher practice DBDM. Hence, to understand how teachers use data to inform their practices--especially to intensify instruction--their preparedness to engage in data use, their values toward data and data collection, the resources to support them, and what facilitates their data use should be clarified.

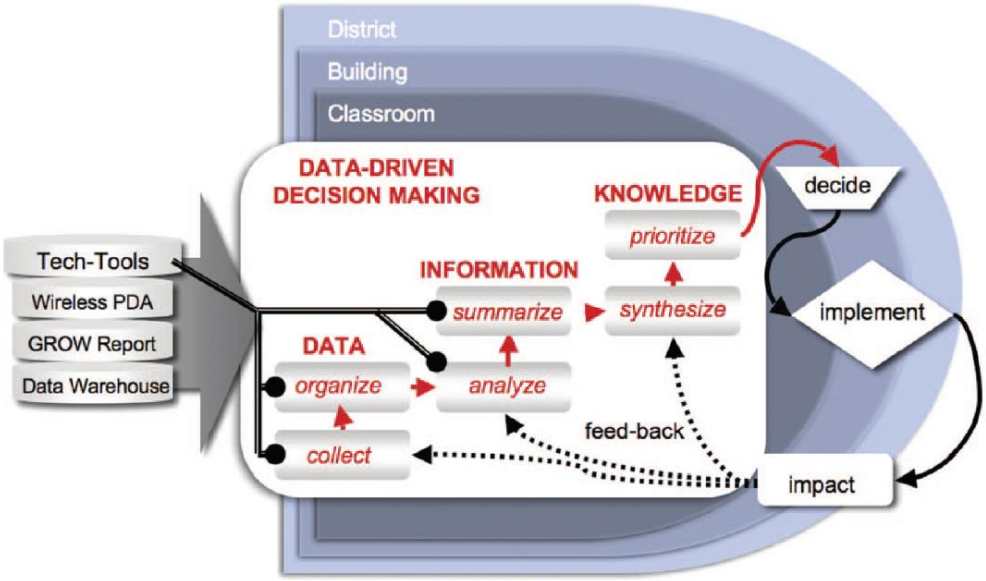
Significance of the Study

The literature on teachers' data use reveals that data use is important for student achievement (Filderman et al., 2018; Jung et al., 2018) and also teachers need to be supported in data use with pre-service or in-service trainings (Gesel et al., 2020; van Kuijk et al., 2016; Wagner et al., 2017; Wayman &Jimerson, 2014). Researchers developed conceptual frameworks to describe ideal steps and ingredients of the data-

based decision making process. For example, the DDDM framework by Mandinach (2012) demonstrates the steps taken by teachers and the nested environment in which the process is affected as shown in Figure 1. However, besides the ideal step-by-step systematic framework, in which teachers make a decision based on knowledge gained through information and data and repeat the process based on the impact of first decision, teachers' data use engagement might be more irregular and nuanced than the framework suggests.

Figure 1

Data-Driven Decision Making Framework by Mandinach (2012)



Note: Data-driven decision making framework for educators at three levels: classroom, building, and district. Reprinted from "A Perfect Time for Data Use: Using Data-Driven Decision Making to Inform Practice," by Author E. B. Mandinach, 2012, *Educational Psychologist, 47*(2), 71-85. Copyright [2012] by American Psychological Association

Teachers' current practices around data use and what they need to learn to engage in evidence-based data use practices need to be explored in more detail. Hence, this study contributes to both education practice and academic research by investigating teacher

needs in learning how to use student data. When teachers' needs and experiences are better understood, teacher educators can develop better pre-service and in-service trainings to improve teachers' data use, or school leaders can provide the necessary supports to enhance teachers' data use. In this study, I use a grounded theory approach to lead to such a deeper understanding.

Grounded Theory Design

Grounded theory research design helps to understand how a phenomenon works or is experienced by creating a theory from data (Corbin & Strauss, 2008). To explore teachers' data use experiences, the grounded theory research approach was selected because the purpose of the grounded theory research is to explain a given situation by identifying the core processes of it (Baker et al., 1992).

Grounded theory data analysis consists of three stages of coding qualitative data such as interviews: initial, intermediate, and advanced coding. Initial coding is an open coding process where the researcher does not impose preexisting categories, but rather explores what the data provides. Initial coding involves categorizing and assigning meaning to data by labelling the lines or phrases (Chun Tie et al., 2019). Intermediate coding helps to refine codes and create broader categories by reviewing codes from initial coding and analyzing their interactions (Chun Tie et al., 2019). In the advanced coding phase, theoretical coding is performed to create a theory of the phenomena, in this case 'data use.' Theoretical codes are used to specify possible relationships between categories developed during focused coding. These findings in theoretical coding are represented as

a set of interrelated concepts, which are integrated into a substantive theory (Chun Tie et al., 2019).

Purpose and Research Questions

The main purpose of this study is to explore how teachers who provide intensive instruction to students engage in DBDM, including how they collect and use student data, as well as their dispositions related to DBDM. The study is intended to build a theory of special education teachers' actual data use and to identify ways to support teachers to use data successfully by using a grounded theory research. This study is guided by the following questions:

1. What are the dispositions (attitudes and perceptions) of teachers toward collecting progress monitoring data and using the data for creating individualized instruction for students who are not responding to the current practices?
2. What types of data do teachers collect and use for individualizing instruction, and how do teachers use the data to inform instruction?

CHAPTER 2

Literature Review

The literature on teachers' data use reveals that DBDM can improve student achievement (Filderman & Toste, 2021; Jung et al., 2018; Keuning et al., 2019). Also, researchers have found that when provided with appropriate professional development support, teachers improve their DBDM expertise (Gesel et al., 2021). However, few studies have explored teachers' current practices around data use and what they need to learn to engage in evidence-based data use practices. In this literature review, I explore teachers' DBDM practices, teacher related factors, and other contextual factors that may impact their DBDM practices. With this literature review, I aim to demonstrate what has been explored so far, and what we need to know more to understand teachers' needs. When teachers' needs are better understood, teacher educators can develop better pre-service and in-service trainings to improve teachers' data use, or school leaders can provide the necessary supports to enhance teachers' data use.

Literature Search

To search for articles and dissertation studies about what affects teachers' DBDM use and about teachers' instructional decision making practices, I conducted a literature search in ERIC and PsycInfo databases using the following search terms: (1) *data based decision making* or *data driven decision making*, (2) *teacher beliefs* or *perceptions* or *views* or *attitudes*, (3) *knowledge* or *skill*, and (4) *instructional decision making*. I also conducted an ancestral search by reviewing references provided in the studies that I

identified for the current paper. Articles that were published in journals and dissertation studies are included in the review to comprehensively answer the research questions.

Inclusion Criteria

Of the studies identified in the database search, I selected those that focused on teacher decision making. The inclusion criteria included (1) having teacher participants, (2) a focus on DBDM or instructional decision making, (3) delivery of a training in DBDM, or (4) an explanation of a framework related to DBDM. I excluded articles focusing on DBDM at district and school levels because the focus of this paper is understanding teachers' instructional decision making experiences.

Literature Review Findings

I conceptualized teachers' engagement in DBDM at three stages for instructional decision making: *before data collection*, *during data collection*, and *after data collection*. Before data collection, I focused on teachers' readiness to start the DBDM process, including teachers' psychological readiness, their knowledge and skills, what complexity level of data and data analysis knowledge they would need, and some barriers and facilitators they could face. In the next section, during data collection, I focused on what data teachers value to collect and at what frequency they collect data. In the after data collection section, I focused on teachers' graph reading skills (as some student data is presented in progress monitoring graphs, especially for intensification of the instruction), and how teachers use the data to inform their practice. I added a section for professional development at the end because it is a very important aspect to see how teachers are prepared to engage in the DBDM process at all three stages.

Before Data Collection

Teachers' Self-efficacy, Beliefs, and Attitudes toward DBDM

Being prepared to learn and implement new practices is a key factor that affects learners' experiences in gaining a new skill or implementing a new practice. Researchers say that teachers are unprepared to engage in Data-Driven Decision Making (DDDM) (Wayman, 2005), and that some of this unpreparedness can be attributed to teachers' low self-efficacy towards engaging in DDDM (Dunn et al., 2013; U.S. Department of Education, 2008, 2010).

Bandura (1997) described self-efficacy as one's beliefs about their "capabilities to organize and execute the courses of action required to produce given attainments" (p.3). One's beliefs affect their actions in doing something (Bandura, 1993). Self-efficacy can be an important part of being prepared for teachers to implement a new practice such as DBDM simply because the more they believe in their own capabilities, the better the chances are for them to adopt the practice and desire to improve their practice. In a study in which teachers were provided a training on DBDM and coaching support for using DBDM in math, van der Sheer et al. (2016) found that when compared to control group teachers, teachers in the treatment group increased their sense of efficacy toward using DBDM from the beginning of the study to the end of the study. Also, they persisted in their high level of efficacy even one year after the completion of the study.

In addition to beliefs of their own capabilities, teachers' beliefs and attitudes toward DBDM can be for any phase of the decision making process, including attitudes toward data collection or using specific measures, and beliefs about making instructional

changes based on progress monitoring data or beliefs about collecting a certain type of data. To better understand teachers' experiences during DBDM, it is important to know about teachers' self-efficacy in engaging in DBDM, their beliefs about different data types, collection of data and making instructional decisions based on the data, and how confident they are in engaging in these activities.

Previous studies have found that teachers are more engaged in practices such as DBDM when they feel more confident with implementation of them. Dunn et al. (2013) conducted two surveys with teachers to measure their efficacy with engaging in data related tasks such as data identification and use, or interpretation and evaluation of the data, and their concerns on collaboration and refocusing. Analysis to identify relations between teachers' efficacy and concerns revealed that teachers are more likely to engage in DBDM activities and collaborate with other colleagues for DBDM when they feel more comfortable with engaging in DBDM. They showed that higher self-efficacy leads to better collaboration among teachers during DBDM. Conversely, when teachers have higher anxiety over using DBDM practices, they tend to collaborate with others less often.

However, many studies have shown different relations between self-efficacy, beliefs or attitudes, and implementation of DBDM. Sandall and colleagues (2004) examined early childhood special educators' attitudes toward the collection and use of data for making instructional decisions. They provided trainings to the educators and conducted interviews with them before and after the training. Analysis of the interviews revealed that although teachers agreed that data collection was critical for student

achievement, they reported inconsistent data collection practices in their classrooms. Prior to the training, teachers also reported that they were not satisfied with their data collection methods.

Similarly, Brawley and Stormont (2014) conducted surveys with teachers to explore teacher perceptions of data collection practices for instructional decision making. About 90% of teachers reported data collection as "very important," but only 66% reported using data for progress monitoring, and less than 33% reported analyzing and summarizing data for children in early childhood settings.

On the other hand, teachers' actual implementation of DBDM, meaning how much and how well they use data, might be questionable. Demchack and Sutter (2019) conducted surveys with teachers to compare their perception of how well they use DBDM and their actual use of DBDM. The researchers surveyed 56 teachers who graduated from a teacher education program from 1995 to 2015. The survey asked questions about their perception of their DBDM use. These teachers also submitted a data sheet in which they reported student data and an equal interval graph. These data sheets allowed researchers to check fidelity of teachers' DBDM implementation. They evaluated the fidelity of implementation by comparing teacher-submitted data sheets to the guidelines teachers learned during their teacher preparation programs. Evaluation of these sheets revealed that teachers did not follow the guidelines provided during their teacher preparation program for implementing DBDM. Also, some teachers responded to the survey that they did not use DBDM procedures provided to them during their teacher preparation program at all. The survey responses of these teachers revealed two main reasons for their lack of DBDM use: (1) change in teachers' role so that they did not need

to use DBDM, and (2) using another data-based decision making system rather than the one taught in their teacher preparation program.

Additionally, beliefs about how well an assessment tool can show student performance can also affect teachers' attitudes toward engaging in DBDM. For example, Rowe et al. (2014) found that teachers reported concerns about using Curriculum-based Measures (CBM) as a progress monitoring tool. CBMs are designed to provide reliable and valid student data in a very simple, efficient, and inexpensive way. CBM is one way to integrate student data into teachers' instructional decisions (Deno, 1985). CBMs can be administered weekly or biweekly for a duration of 1-3 minutes. Teachers can also graph their students' scores and observe their students' progress over time. In Rowe et al.'s (2014) study, teachers' concerns about CBMs mostly stemmed from the possible inconsistency in administering or scoring of assessments by teachers, or the assessment tool itself. If teachers do not value the data they get from the tool they used, this may affect their engagement with instructional decision making as well.

The difference between teachers' beliefs and their actual use of data can stem from many reasons. To remediate the difference and improve teachers' DBDM practices, one should understand the barriers related to teachers' collecting or use of data. Ruble et al. (2018) surveyed teachers to show the correlation between their perceptions of data and their actual use of data. They focused on three aspects of perception: attitudes, subjective norms, and perceived behavioral control. Attitudes such as one's beliefs about the importance of collecting student data and subjective norms such as others' beliefs about how important collecting student data were found to affect teachers' intentions toward data collection. However, their beliefs did not reflect teachers' actual use of data. Rather,

teachers' beliefs about how much it is possible to collect data (perceived behavioral control) affected their actual data collection and data use. This result shows that solely positive attitudes toward data collection do not always lead to increased use of data in educational settings. Teachers should also believe that there are no or minimal barriers to collect student data regularly to use the data in instructional decision making.

Teachers' Knowledge and Skills about DBDM

Individualization through instructional adaptations is important especially for struggling learners. For successful individualization and intensification, teachers may benefit from following a systematic framework such as DBDM. Fostering teachers' knowledge about using this framework and about content areas are as important as constructing these frameworks and other evidence-based practices. Previous researchers found teachers' knowledge about intensification and content areas to relate to how successfully they implemented intensification (Cunningham et al., 2004; Spear-Swerling & Zibulsky, 2014). For teachers to be successful at data-driven decision making, they should know more about systems such as Response to Intervention (RTI) in which they would use data-base decision making (Al Otaiba et al., 2019) and also the tools that they would use to collect data such as CBM (Espin et al., 2017). Researchers have suggested that teachers with greater understanding of data and the measurement tools they use (e.g., CBM) may result in better use of data in instructional decisions (Espin et al., 2017). Increased content knowledge has also been found to be positively related to teachers' self-efficacy (Swackhamer et al., 2009).

Despite the importance of gaining the required knowledge and skills in an area, many teachers still find it difficult to tailor instruction based on individual student needs, mostly due to lack of preparedness (e.g., Boardman et al., 2005; Roehrig et al., 2008; Stecker et al., 2005), and some teachers were found to have the least amount of knowledge in the area of DBDM when they were surveyed about RTI implementation (Al-Otaiba et al., 2019). Hence, the role of teachers' knowledge and skills in decision making should be understood and be a focus for improved practices.

Greenberg and Walsh (2012) prepared a report to demonstrate how teacher preparation programs (undergraduate and graduate schools) prepare future teachers to assess student and classroom performance, and make instructional decisions. They focused on three main areas of teacher knowledge that are needed for assessment: (1) assessment literacy to use tools to measure student progress, (2) analytical skills to analyze student performance, which is measured by the assessment tools, and (3) instructional decision making to inform and plan instruction based on the student performance analysis. They looked at 180 programs' coursework and the syllabi for the courses to show how much attention is given to these three areas. Results showed that more than half of the programs provided very limited or no training to build assessment literacy of teachers. The rest of the programs provided what they referred to as partially adequate and adequate (21% and 21% respectively) amount of training to students to understand assessments and become familiar with different kinds of classroom and standardized assessments. For the other two areas, the numbers are not any better. Less than 1% to 8% of the programs provided adequate or partially adequate knowledge to students to learn skills to understand the assessment results and analyze assessment data.

Similarly, for instructional decision-making, less than 2% to 7% of programs provided adequate or partially adequate training to future teachers.

To look more in depth at how teacher training programs prepare pre-service teachers for assessment in schools, in a single case design study with pre-service teachers, Love and colleagues (2019) developed a rubric to observe pre-service teachers' data collection quality and their use of observational data to make data-based decisions. The rubric included a variety of items such as identifying appropriate data collection measures, or identifying at least one instructional next step based on student data. They found that even though these teachers were receiving a measurement course in their teacher preparation program, their scores on the rubric were very low. Their data quality scores went up after they received data collection templates and instruction in data collection. However, their high scores on the rubric were consistent when they received feedback on their use of the templates. This finding shows that preservice teachers are able to perform some parts of data collection with quality, however; they do not always perform all the necessary steps while collecting observational data. They also may lack in identifying instructional next steps based on the data they collect. With the introduction of the necessary instruction and feedback, they can increase their quality of data collection and use.

With experience in school settings, some teachers improve their data collection and interpretation skills. In a study that compared teachers' graph comprehension with that of graph reading experts, van den Bosch and colleagues (2017) found that inservice teachers' interpretation of progress monitoring graphs were as comprehensive as other educational experts' interpretation, but not as good as progress monitoring graph

experts'. This result indicated that they were able to interpret data accurately; however, teachers lacked in making data-to-instruction links based on graphs they interpreted. This shows that even though teachers are able to read and interpret graphs accurately, they either do not do it comprehensively or they are not able to link the interpretation from graphs to the instruction, implying that they lack skills for making instructional decisions based on student progress monitoring graphs.

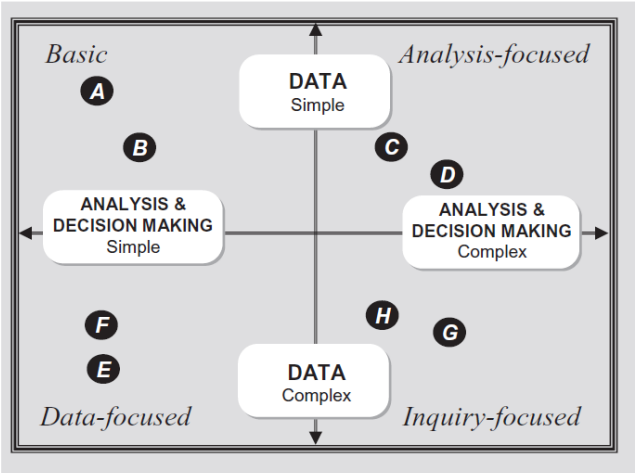
How Simply or Complexly Educators Collect and Analyze Data

DBDM is a framework, which means educators can utilize this framework for different purposes and include a variety of data sources depending on the purpose. One teacher can use the DBDM framework to look at students' specific needs related to a skill or behavior and to individualize the intervention according to these needs, or a principal can use the DBDM framework to decide on allocation of resources to increase achievement in state tests.

Ikemoto and Marsh (2007) provided examples of different data-driven decision making (DDDM) models that differ in the complexity of collected data and data analysis required. Figure 2 shows how they conceptualized DDDM models. The upward arrow implies simple data where educators use one or two data sources, and the downward arrow implies more complex data sets. The left arrow shows the necessity of simple data analysis whereas the right arrow shows the necessity for more complex data analysis.

Figure 2

Data Driven Decision Making Models by Ikemoto and Marsh (2007)



Note: A framework for decision making where complexity of data and analysis changes for different purposes. Reprinted from "Cutting Through the "Data-Driven" Mantra: Different Conceptions of Data-Driven Decision Making," by G. S. Ikemoto, and J. A. Marsch, 2007, Yearbook of the National Society for the Study of Education, 106, 105-131. Copyright [2007] by the Yearbook of the National Society for the Study of Education.

Ikemoto and Marsh (2007) argued that decision making happens in a variety of ways for different purposes in an educational setting. For specific purposes, educators need to look at more complex data structures to identify an underlying problem, whereas some cases require teachers to focus on one or two assessment results to make a decision. Points A, B, C, D, E, F, G, and H in Figure 2 refer to samples of different DDDM models. These examples include cases where educators use data to target teacher professional development on areas of weaknesses, to differentiate services, to decide to allocate resources, or to improve school capacity. Example C in "analysis-focused model" represents differentiating services for low-performing students where a teacher, principal, and school coaches held a meeting to discuss a student's needs and differentiate instruction based on the needs. In example C, educators use very basic or limited data

sources; however, they engaged in an iterative process of examining data. Since the placement of example C requires more complex data analysis, it can signal the need for training in data analysis and decision making for teachers.

Barriers and Facilitators Toward Data Use

Teachers' graph comprehension as well as their prior beliefs and values about data use can directly affect their data use experiences. In addition to these teacher-related factors, other aspects can facilitate or limit teachers to engage in data-based decision making. For example, the values, priorities, or resources available in a school district creates the context in which teachers perform their practices. According to Coburn and Turner's (2011) data use framework, educators' data use process interacts strongly with the organizational and political context. Data use routines, accessibility of data and norms, leadership, and power and authority frame organizational and political context for data use in schools.

Coburn and Turner (2011) define "data use routine" as a pattern that affects how people interact with data and with each other during data use. For example, with whom data are discussed, at what frequency, or for which purposes data are used are dependent on a data use routine of schools. Data can be used for only a couple times throughout a school year for parent conferences, or it can be collected, analyzed, and used to make decisions in regular grade level meetings.

According to Coburn and Turner (2011), the dimensions of data use routines include accessibility of data, time allowed to engage in data related tasks, norms about discussing and sharing data, leadership, and power relations between teachers and leaders or schools and districts or communities. They discuss time as a central element in data

use routines since when it is absent, decision making is less likely to happen, and remains unresolved. With the fact that time for data use is not always provided or designated (Ikemoto & Marsch, 2007), limited time can be a barrier for teachers to engage in DBDM.

Coburn and Turner (2011) also discussed availability of data as one of the important dimensions of organizational context simply because schools do not collect every type of data and the data are not always available throughout the school year. They argued that what data is available to whom and when shapes data routines at schools and districts. Furthermore, even though the data are available to teachers, the norms about discussing and sharing data should allow educators to openly discuss student data and ask questions. Finally, Coburn and Turner (2011) view leadership and power relations as very influential in educators' data use routines since authority plays a key role in organizational context. According to their framework, leadership and power relations can be facilitators of data use when they provide an environment in which educators are supported to use data, ask questions, and provided resources.

Moreover, Ikemoto and Marsh (2007) suggest that perceived validity of data sources can affect teachers' use data use. Teachers reported that they rely on data other than state test scores to inform their practice and they were more likely to use multiple data sources including their own data collection. Hence, availability of reliable data sources such as assessments or benchmarks can facilitate teachers' data use to inform practice. Ikemoto and Marsh (2007) also point out that staff capacity and support are other factors that can facilitate data use. They report that the majority of teachers they surveyed reported low levels of feeling prepared to interpret and use student data. On the

other hand, some school districts invested in supporting school staff with data analysis by hiring staff with higher data analysis skills. Extra support with data analysis to teachers may result in better engagement in data use. This support may be provided by hiring data experts or providing professional development to the teachers to increase their knowledge and skills.

Additionally, a supporting leadership and trustworthy organizational culture in schools can enable an environment in which looking at data, developing hypotheses and testing these hypotheses are encouraged. In such an environment, teachers feel comfortable to discuss student data and the effectiveness of their instruction and practices with colleagues, parents, and their leaders (Coburn & Turner, 2011; Ikemoto & Marsh, 2007; Mandinach & Honey, 2008). Furthermore, Datnow and Park (2013) discuss teacher collaboration as a facilitator of data use and they argue that it is highly affected by leadership support. This support may be to provide a structured time to collaborate, set expectations for data discussions, provide protocols for data discussions and encourage teacher groupings based on subject matter (Datnow & Park, 2013).

Last, tools such as software systems that are accessible to teachers can positively affect teachers' engagement in data-related tasks (Ikemoto & Marsh, 2007). However, these tools do not guarantee teacher engagement with data use. Cho and Wayman (2014) interviewed and observed teachers to identify factors affecting teachers' use of computer data systems. What they found was very interesting: Even though technological data systems enhanced accessibility of data, teachers did not always used the data systems to make decisions. Rather, teachers' sense-making of the data correlated with their data use and data systems use. This result demonstrates that without a sense of data and how to

use data toward instructional change, computer data systems would not change a lot in teachers' data use practice. Teachers tend to utilize more from these systems when they understand the presented data better and know what the numbers or graphics mean in terms of student progress. Hence, computer systems may help with data practices; however, teachers' knowledge about data and data use affect their practice greater than the availability of tools.

Summary: Before Data Collection

Data-based decision making requires teachers to integrate a variety of skills to implement and inform their practice. Hence, it is important to improve teachers' knowledge and skills for better practices. When provided with training and support, teachers can improve their knowledge and skills to adopt and implement new practices (Gesel et al., 2020; McMaster et al., 2020). In addition to that, what teachers think about assessments, how they collect and analyze data, and how much time they spend on these tasks also affects their implementation. Psychological preparedness of teachers such as having higher self-efficacy or positive attitudes is crucial to adopt the new practices in their classroom routines. However, it is not adequate to fully adopt practices such as DBDM. For example, teachers have positive perceptions and attitudes toward collecting and using data; however, they reported minimal use of data (Brawley & Stormont, 2014; Sandal et al., 2004) or they were found to be using data in a way not intended (Demchack & Sutter, 2019).). Teacher readiness (knowledge, skills, self-efficacy, perceptions, and attitudes) is a factor that can affect and facilitate teacher engagement with data use practices.

In addition to teacher readiness, some external factors can affect teachers' data use. School culture, norms, organizational context, leadership, power and authority construct a data use routine that shapes teachers' data use in their schools. These routines can either create an environment in which teachers can collect data, discuss the data, and test their hypothesis or a more restrictive environment that limits teachers' ability to use data. Accessible data, time to engage in data use, and establishing norms around data discussion are important facilitators of teachers' data use (Coburn & Turner, 2011). Also, leadership is key to creating a supportive data use routine.

During Data Collection

What Data Do Teachers Find Useful to Collect?

School districts collect a lot of data, ranging from satisfaction surveys to student achievement scores. However, educators do not use all the data they collect for every decision they need to make; some data are more useful than others to make a specific decision. For example, for school accountability purposes, one district might use standardized test scores, graduation rates, or school dropout data, whereas a teacher could use formative assessments to evaluate the effectiveness of their instruction. Hence, in this section, I focused on what the literature shows that educators collect data on and which data they use for instructional decision making.

Marsh et al. (2006) found that administrators and teachers reported using state tests and local assessments more than other data sets to make data-driven decisions. State test data is more accessible than any other data simply because it is mandatory and it provides detailed results for student achievement. Marsh et al. (2006) also found that some teachers find state test data unhelpful to make instructional decisions because the

results come late in the year, and thus they rely more on local assessments, which occur more frequently than state tests. In addition to local assessments, teachers also reported using classroom tests and assignments to monitor how well students are doing. Moreover, attendance, graduation, or mobility data are also used mostly for evaluating school and principal effectiveness.

Similar to Marsh et al. (2006), Pham (2011) conducted a survey with 27 elementary school teachers for a dissertation study to gain information about which assessment types teachers are using, and what they do with assessment data for literacy development. The results of the survey revealed that teachers found common formative assessments to be more helpful and used them more frequently than other types of assessments such as district benchmarks or standardized assessments. One teacher noted that the reason why they prefer using common formative assessments is the accessibility of the student data; they can use these assessments whenever they need to see their students' needs in literacy. Other teachers shared that the reason why they favor formative assessments is that these assessments relate to classroom goals and align with the curriculum better. The results and the teacher testimonies demonstrate that teachers value the accessibility and efficiency of assessments so that they do not need to wait for results to see how their students are performing and how well their instruction is working. Easy access to formative assessments may provide frequent opportunities for checking students' response to instruction.

In another dissertation study, Chitwood (2018) asked teachers how they perceive different data sources as being useful for different purposes. Teachers reported that they found teacher-created benchmarks, curriculum embedded assessments, English language

acquisition data, and state achievement data more relevant in adjusting core curriculum and instruction for students. For identifying students for academic or behavioral intervention, teachers found teacher-created benchmarks, English language acquisition data, and suspension data more relevant than other kinds of data. These results revealed that teachers found the assessments and benchmarks created at their local site or by themselves more useful especially for identifying students who need intervention and for making instructional decisions.

With What Frequency Do Teachers Collect Data?

Farley-Ripple et al. (2021) conducted a study to observe how teachers engage in a data reporting system to understand their data use practices. The researchers observed how frequently teachers used a progress reporting system by analyzing system access logs. These logs provided information about the time and date of access, who accessed the data and what data they accessed. The results from analysis from system access logs revealed that teachers seemed to use the data system more often during the testing window in a school year--for example, around the beginning of fall or towards the end of the spring semester. They used only some of the data available to them, and their use was inconsistent throughout the school year. Also, some assessment tools were reported to be used more frequently than others, which may imply that teachers have preferences for which data sources they want to use. The variation in frequency of using assessment tools can be due to different reasons, for example, differences in the representation of the student data or differences in the aim of the data use.

Chitwood (2018) surveyed teachers about their data use routines to know what data are available to them, at which frequency they use those data, and what supports are

available to them from leaders and their district for using data to make decisions. The survey results from 104 teachers from a Western state showed that teachers were using district-created or curriculum embedded assessments and teacher-created benchmarks more often than any other kind of data source including state achievement data. The researcher pointed out that the frequency of data use was correlated with the availability of that data source. For example, teachers reported that they had less difficulty in gaining access to district created or curriculum embedded assessments and teacher created benchmarks than other data types. They reported the most difficult to access data source is suspension data. Parent surveys and teacher surveys follow the suspension data. Similarly, teachers also reported higher levels of their own expertise with the data they use more frequently. Frequent use of a data set may result in teachers' higher comfort levels and understanding of that data set.

Summary: During Data Collection

The literature revealed that educators collect a variety of data and use these data for different purposes. Even though educators value standardized assessment data for making data based decisions, they prefer to collect formative assessment data, because of the accessibility of these assessments. Teachers can easily administer formative assessments and evaluate their students' learning immediately, whereas with state assessments they need to wait until the end of the school year.

The frequency of teachers' data use depends on the availability of the data sources. When the results from state tests are available, teachers use the data to evaluate student progress and make decisions. These results imply that teachers prefer to use formative assessments but to make educational or instructional decisions, they tend to use

standardized test results. This contradiction can be caused by the lack of knowledge on how to use formative assessment results toward making instructional changes.

After Data Collection

Teachers' Graph Reading Skills

Data use to inform instruction does not end with collecting and organizing data. Teachers also need to analyze the data including reading graphs on which data are presented, and making inferences based on what the graphs show. Analysis of graphs that show student data may not be required for all types of decisions made at schools, however it is an important step when teachers individualize instruction, since individualization requires a close monitoring of student progress (Stecker et al., 2008). The skill of reading and interpreting graphs is called graph comprehension (Friel et al., 2001). Friel et al. (2001) described graph comprehension at three levels: (1) reading the data, meaning obtaining information from the graph and understanding the data; (2) reading between the data, meaning interpreting the data; and (3) reading beyond the data, meaning evaluating the data within a context and making inferences. Teachers need to be familiar with the components of graphs, proficient at visual analysis of progress monitoring graphs, and be familiar with their context to make connections between data and student progress.

To explore teachers' understanding and interpretation of student progress monitoring graphs, Espin et al. (2017) conducted a study with teachers and graph reading experts to show how well teachers are able to analyze and make inferences from graphs compared to experts. They used a procedure called "think-aloud" where teachers were given a variety of student progress monitoring graphs and were prompted to talk

instantaneously about what they were seeing on the graph and thinking about the student's progress. Progress monitoring graph reading experts rated teachers' interpretation of graphs. Teachers were also asked to report their experience with teaching and using progress monitoring graphs. The results revealed no significant correlation between teachers' years of experience or their experiences using progress monitoring graphs and experts' ratings of understanding and interpreting graphs. This result indicates that using or creating graphs may not guarantee improved data literacy skills of teachers.

Van den Bosch et al. (2017) employed similar think aloud procedures with teachers to compare their progress monitoring graph comprehension with educational experts and general graph reading experts. Similar to Espin et al.'s (2017) study, they asked teachers questions to think aloud while examining student progress monitoring graphs to demonstrate how teachers engage in different levels of graph comprehension (reading the data, reading between data, reading beyond the data, see Friel et al., 2001). The researchers also compared teacher responses with experts with educational backgrounds and others who had general graph reading expertise not specific to educational graphs. The comparison revealed that teachers were able to talk about the graphs and make inferences as coherently and accurately as general graph reading experts; however, they produced less coherent and accurate sentences than educational graph reading experts. Teachers were lacking data-to-data comparisons and linking data to instruction. These results imply that teachers may have generic knowledge about graphs; however, they need to improve their skills of reading between the data and beyond the data.

Later, van den Bosch and colleagues (2017) developed three different trainings to improve teachers' progress monitoring graph comprehension and to see which training was more efficient. Researchers developed a training focusing on interpreting progress monitoring graphs and how to link student data to instruction. One group of teachers received only this training, while a second group of teachers received the same training and also interactive instruction on how to interpret data. A third group of teachers received the same training plus interactive instruction on interpreting data and linking data to instruction. At the end of trainings, teachers were asked to describe the graph as if they were describing it to a parent, and their responses were compared. Results showed that all teachers who received any kind of training improved their comprehension when compared to a control group; however, teachers who received additional interactive instruction made more "data to goal" comparisons than the training-only group. None of the training groups showed differences in linking data to instruction skill.

In a dissertation study that aimed to explore teachers' perceptions of the adequacy of their professional development (PD) in the area of DBDM and their graph reading skills, Wallace (2019) shared a national survey with elementary school teachers and administrators, and 451 responses were recorded. The survey included questions to explore how satisfied teachers were about their PD in DBDM, and whether these teachers were able to read and interpret progress monitoring graphs accurately. The researchers found that the majority of teachers were not able to accurately read and interpret trend lines on the graphs, and almost 82% of teachers could not draw information to compare students' progress with their peers' on the given sample graphs. Ironically, teachers who were not successful at interpreting and reading graphs responded to questions about the

PD with high satisfaction. These results suggest that teacher educators and preparation programs should focus on more targeted and intensive training in graph comprehension and how to use graphs, because teachers may not be aware of their need in this area.

How Teachers Use Data and What They Change

Pham (2011) also asked teachers what data they use to make decisions and observed their data meetings to see how teachers use the data. Even though a majority of the teachers favored using formative assessments to check the effectiveness of their instruction, they all reported using data from standardized tests to make decisions. The decisions they made were mostly focused on creating goals for students and revising these goals. Even though teachers reported a high preference for formative assessments, the reason why they use standardized assessments to evaluate the effectiveness of instruction and for decision making may be caused by their familiarity with the analysis and data set. Teacher may know (or have more resources for) how to analyze and interpret standardized tests data to make instructional decisions.

Moreover, Pham (2011) gave a list of data analysis approaches in the survey, and asked teachers to select which ones they use, for what and how frequently. Teachers selected item analysis, disaggregating data by student subgroups, and identifying students with common areas of skill needs. Teachers shared that they do item analysis to identify strengths and weaknesses of the instruction they provide, while they look at the disaggregated data to target student subgroups that needs additional resources to increase overall student achievement for school accountability. Finally, they reported that they analyze the data to identify students with specific needs in literacy. However, how

teachers analyze the data and change their instruction or intensify the interventions to meet student needs based on these data remains unanswered.

The Effect of Professional Development (PD)

As discussed in previous sections, DBDM requires many skills that teachers should have, and teachers' knowledge is essential for effective implementation (McMaster et al., 2020). Furthermore, teachers' data use is affected by many internal and external factors. Teachers use different kinds of data for different purposes, and they tend to use some data types more often than others. The reasons why teachers rely on some kinds of data more than others, or why teachers interact with data in certain ways, is uncertain. One explanation might be the previous training experiences of teachers, which could affect their assessment preferences, or the resources available to teachers that affect their data choice. In this section, I looked at the literature to demonstrate how teacher preparation programs have prepared teachers and how in-service trainings and support affected teachers' DBDM.

Teacher Preparation Programs

Preparing teachers who are highly qualified for improved teaching and student outcomes is undoubtedly one of the most important purposes of teacher preparation programs. Teacher candidates invest money, time, and effort into teacher preparation programs to learn necessary knowledge and gain skills they need in classrooms. Hence, one should also consider how teacher preparation programs support teachers' development for their DBDM implementation.

Ledesma (2013) surveyed leaders in teacher preparation programs in Virginia to explore how programs address the necessary skills that teachers need to acquire to engage

in DDDM. Survey questions asked leaders their opinions about how well programs support teachers' development of skills to use data through coursework and fieldwork. The majority of leaders agreed that their programs provide enough content and opportunities to learn how to construct and administer informal assessments to evaluate student progress. Through necessary coursework and fieldwork experiences, pre-service teachers learn about informal assessments that they will use later in their careers. When the survey asked about standardized test data analysis, the program leaders reported a different response; the results revealed that pre-service teachers do not learn about data analysis of standardized tests as much they learn about informal assessments. Even though not all teachers are required to learn to administer standardized assessments, teachers should be familiar with what results on a test would mean for student achievement or progress to be able to inform their practices.

Furthermore, survey responses showed that for statistical knowledge and skills of pre-service teachers, the situation is similar with data analysis. Teachers have a variety of experiences with statistics. In addition to what pre-service teachers received in coursework, program leaders reported that the opportunities to experience data use and instructional decision making during fieldwork is very limited. These results revealed that teacher preparation programs support pre-service teachers' knowledge and skills on informal assessments; however, they should also emphasize the support for improving data literacy of teacher candidates.

To further investigate how teacher preparation programs support and prepare pre-service teachers, Mandinach et al. (2015) surveyed faculty and staff from 501 institutions that offered a baccalaureate or higher degree in education across the United States.

Survey questions focused on understanding whether programs provide a stand-alone course on data related skills or whether they integrate those skills with other courses such as assessment. In addition to the questions in the survey, participants were also asked to share the syllabi of their courses and their state's licensure requirements. The results of the survey revealed that, for a majority of the teacher preparation programs, a stand-alone data use course is a requirement for a teaching degree, intended for preservice teacher candidates, mostly taught at the undergraduate level, and it includes practices in which student can access and examine mock or real student data to make educational decisions. It was also found that stand-alone data use courses mostly focused on assessment data such as interim assessments, formative or standardized assessments, and there was less attention to non-assessment data such as attendance or behavioral data. An interesting finding revealed that different institutions from the same state responded about licensure requirements for data use differently; while one of them answered that their state has a requirement of having a data use related course, another faculty responded to the questions saying no. This contradiction between different schools from the same state implies confusion about the requirements and also the lack of influence of state requirements on college courses. Further review of course syllabi revealed that the majority of courses focused on the design, implementation, and analysis of different kinds of assessments, such as designing quizzes or tests. Only a handful of courses emphasized statistics for assessments, and only one course that was specifically for data-driven decision making emphasized the use of data beyond achievement data.

Wagner et al. (2017) compared preservice teachers' graph comprehension with graph reading experts. They found that preservice teachers produced fewer inferences and

less accurate interpretation of the graphs. Graph comprehension seemed to be important to interpret student data and make instructional changes by linking these data to practice. Hence researchers suggested to change teacher preparation programs by incorporating more opportunities to practice graph interpretation and providing extensive coaching in graph interpretation during student teaching to improve preservice teachers' graph comprehension.

In-service PD

Jimerson and Wayman (2015) conducted interviews with principals and focus groups with teachers, support personnel, and central office administrators from three school districts in Texas to gain information about participants' beliefs on skills that needed to be effective data users and how each district provided professional learning for data use. Researchers recorded and transcribed all the interviews and focus group discussions for qualitative analysis. Further, they collected any documents participants referenced during interviews and focus groups. Interview and focus groups protocols addressed questions around how participants learn a new skill, how to be an effective data user, and how the district supports participants' professional learning for data use. A majority of the participants shared that generating appropriate questions and accessing and using data systems are among the needs of teachers for effective data use. Asking appropriate questions is the key to know where to look and how to evaluate the data. Also, teachers can engage in DBDM more when they know how to use the data available to them. Furthermore, being proficient in data literacy and integrating data use into practice such as instruction and assessment were reported by participants. Importantly, some participants shared that linking solutions to student needs is the most challenging

part of data use at schools. They reported that they have a lot of resources and solutions that can remediate the needs of students, however matching these solutions to the needs is challenging. Hence, even though teachers understand and interpret student data appropriately, they are not always able to link appropriate solutions to these needs. Collaboration among teachers was reported as another need for effective data use, however not all participants thought that collaboration is essential towards effective data use.

Van den Bosch et al. (2019) provided teachers with different training approaches to see how well they improve their progress monitoring graph comprehensions and their data-to-instruction linkage skills. In the first approach, teachers were provided with a basic explanation of progress monitoring graphs and how to read and interpret these graphs. In the second approach, in addition to the basic approach, teachers were provided opportunities to practice interpreting data on graphs. In the last approach, in addition to the second approach, they were provided a case example of a teacher who is about to make a data-based decision with five possible decisions, and asked to select one possible decision and explain their reasoning. They found that regardless of which training approach they received, all teachers improved their data comprehension skills, and there were no differences in how well they linked data to instruction between teachers. Even though the researchers expected to see a greater increase in teachers linking data to instruction skills in the last training approach, this group of teachers did not show a significant difference from teachers in other groups. One reason could be that all teachers received the basic training and the questions in the basic training were enough to follow questions to make instructional decisions, and practicing this skill with a mock data and

one case study would not add much more on it. What could happen if these teachers were asked to collect progress monitoring data for their students and asked to make instructional decisions for their own students is still unknown. They may show differences in how they are linking data to instruction when they were asked to do it for actual students. Another reason could be the length of the training. Even though the last training approach provided more opportunities for practicing the target skill, all training approaches lasted about the same length (15-45 minutes) for teachers to show significant differences.

In another study, McMaster et al. (2020) developed a PD program to support teachers' implementation of data based instruction (DBI) in early writing. DBI is a systematic framework in which teachers use assessment and intervention in cyclical way to inform their practices and meet the needs of students. It also includes a data-based decision making framework where teachers provide research-based interventions, monitor student progress regularly, and make instructional decisions based on student data. Their PD program included workshops on writing interventions, curriculum based measurement for writing, and data based decision making. They also provided tools that teachers can use in their classrooms and biweekly coaching support throughout the study. Participant teachers had opportunities to attend workshops, practice what they learned by implementing interventions, assessments, and decision making with their own students, and receive feedback. Researchers measured teachers' knowledge and skills at pretest and posttest and compared their scores with a control group to see the effect of the professional development program. They also observed teachers' implementation fidelity throughout the study to evaluate how well teachers adhere to the program. Their results

showed that teachers who received the PD improved their overall DBI knowledge from pretest to posttest when compared to control group. Teachers also reported that they made instructional changes by using student progress monitoring data at least once a month, whereas control teachers reported not making any changes or used intuition when they made any.

Consistent with other research, McMaster et al. (2020) found positive effects of PD on teachers' outcomes relates to data use and DBI. To evaluate how effective PDs are on teachers' knowledge, skills, and self-efficacy in DBDM, Gesel et al. (2021) conducted a meta-analysis by comparing effect sizes of studies. They analyzed 28 studies by using a codebook and calculating effect sizes to assess study quality and how effective the provided PD in those studies. The result of this study, with reported effect sizes ranging from -1.24 to 3.53, revealed a significant positive effect of DBDM PD on teacher knowledge, skills and self-efficacy, especially when PD is provided under ideal, research supported conditions.

Additionally, ongoing support to teachers to implement progress monitoring assessment and data-based decision making practices appeared to be important and positively related with student achievement (Jung et al., 2018; Stecker et al. 2005). In their review, Jung et al. (2018) reviewed effect sizes of 57 studies to examine teachers' use of data based instruction on student achievement and reported effect sizes ranging from -0.12 to 0.86. They found that having small group problem solving support had the largest effect (g= 0.86) on student achievement. Hence, teachers to who receive PD and ongoing support seem to engage in data use effectively.

Summary: Professional Development

Analysis of literature revealed that teachers often receive necessary training and support to administer assessments and understand the results, especially for formative and classroom assessments. It is possible that this fact also affects teachers' preferences toward using formative assessments to inform their practice. However, it is not very clear how much statistical analysis knowledge was received by teachers, which is important to carry out data based decision making. Also, in schools of education, the introduction of student data is very limited to specific kinds of assessment data.

On the other hand, in-service trainings seem to be effective to increase teachers' knowledge and skills in data use and DBDM. However, linking analysis of student data to instruction seemed to be the hardest part and needs further attention in in-service professional development. Interviews with educators revealed that teachers need to master asking appropriate questions, being data literate, and matching available resources to the student needs based on data interpretations.

Conclusion

In conclusion, from the available literature, teachers seem to have positive beliefs and attitudes toward data us in general and most of them seem to have high self-efficacy. Yet, it is questionable how well teachers follow rigorous and systematic data collection and analysis for instructional purposes. Teachers' data collection and analysis practices seem to be affected by outside factors such as state wide testing times or availability of data at district level. Teachers seem to have a level of knowledge on how to read student data and progress monitoring graphs, but they found to be less knowledgeable or less skilled on transforming data to instructional practices. Teachers collect a variety of data

for multiple reasons, yet it is not clear how they decide to choose which data to collect, or how much a teacher's willingness affect their data use practice. Teachers' data use engagement should be explored in depth to understand the decision making dynamics, their selections on data related activities, and how they transfer inferences from data to the instruction.

Chapter 3

Methodology

This chapter will cover: (a) purpose of the study and research questions, (b) research design, (c) setting and participants, (d) measures and other data collection tools, (e) procedures, (f) data analysis, (g) privacy and ethical considerations, (h) validity and reliability of the study, and (i) summary.

Purpose of the Study and Research Questions

The main purpose of this study is to explore how teachers who provide intensive instruction to students engage in DBDM, including how they collect and use student data. The literature reveals that teachers' data use is important for student achievement, and also teachers need support in data use with pre-service or in-service trainings. However, few studies have explored teachers' current practices around data use and what they need to learn to engage in evidence-based data use practices. Hence, this research contributes to both education practices and academic research by investigating teachers' decision making practices and making inferences about teacher needs in learning how to use student data. When teachers' needs are identified, teacher educators can develop better pre- and in-service training to improve teachers' data use, and school leaders can provide the necessary supports to enhance teachers' data use.

Considering the main purpose of the study, the following questions were addressed in this study:

1. What are the dispositions (attitudes and perceptions) of teachers toward collecting progress monitoring data and using the data for creating individualized instruction for students who are not responding to the current practices?
2. What types of data do teachers collect and use for individualizing instruction, and how do teachers use the data to inform instruction?

Research Approach and Design

A qualitative research design was used to explain the experiences of special education teachers with data-based decision making for tailoring instruction. To do so, I used grounded theory design to generate a substantive theory about teachers' data use experiences. The grounded theory research approach was selected based on Baker et al.'s (1992) definition of grounded theory research design: the purpose of the grounded theory research is to explain a given situation by identifying the core processes of it. To supplement this design, a quantitative approach was used to provide descriptive information for research question 1 from two surveys about participants' dispositions toward data use and characteristics of data use.

Setting and Participants

Data for this study were collected using an online survey and conducting remote interviews. Participants filled out an online survey by using a link which was sent to their email address or was posted on a social media post. Participants also joined a remote interview with the researcher on Zoom.

Ten special education teachers from different states across Midwest and Southeast participated in the study. All of these teachers were teaching academics (reading, math, writing, etc.) to students who have goals in any of the academic areas in their Individualized Education Plans (IEP)s. One teacher was teaching both elementary and middle grade students. Ninety percent of participants were female, and 10% male. Participants reported their race as White (80%), African American (10%) and Asian (10%). The average years of teaching experience was 12.4 with a minimum of 2 and maximum of 32 years.

Initially, 22 people completed the survey. However, when contacted to schedule an interview only 10 teachers responded and participated in an interview to complete their participation. Four out of 22 people were identified as scam and were not included in the study. The survey data reported in this study is only from teachers who completed both survey and interview.

Measures and Other Data Collection Tools

Data Use Survey

Data Use Survey (see Appendix A) was adapted from Prenger and Schildkamp's (2018) study. The original survey included questions to gain information with regard to data use for accountability, school development, and instructional purposes; along with perceptions of school organizational characteristics, user characteristics, and data characteristics. Respondents were asked to express their agreement with the items on a 4-point scale: strongly disagree (1), disagree (2), agree (3) and strongly agree (4). For

questions regarding “data use for instructional purposes,” respondents were asked to indicate how often they use data for specific instructional purposes on a scale from 1 to 6: never, yearly, a couple of times per year, monthly, weekly and a couple of times per week.

The survey included 62 items without adaptations. Prenger and Schilkamp (2018) designed this survey based on classroom curriculum assessment data since it was found to be among the most frequently used type of data among teachers. The scale included items based on four categories: feedback, adaptive instruction, learning time, and purposeful teaching, which are combined in one dependent variable. Five items on the scale referred to data use as informing instruction for feedback (e.g., ‘I use curriculum assessment results to provide feedback on students’ motivation’). Fourteen items were related to adaptive instruction, which examine teachers’ actions that focus on purposefully adapting their instruction to the differences between students (e.g., ‘I use curriculum assessment results for providing extra instruction to weak students’). Five items referred to purposeful teaching (e.g., ‘I use curriculum assessment results to set educational goals’) and five items referred to the use of data in relation to learning time (e.g., ‘I use curriculum assessment results to determine additional homework’). Cronbach’s alpha coefficients for the survey categories have ranged from 0.72 to 0.94 (Schildkamp et al., 2016). The original survey and the reported Cronbach alpha scores of survey categories can be found in Appendix A. The score range for the first 50 items was from 1 to 4, and for the last 12 items was from 1 to 6. The highest score participants can get is 272 and the lowest is 62.

Since the focus of the current study on teachers' data use for instructional changes and tailoring instruction for students, I removed the categories for accountability purposes and data use for school development purposes. Also, I changed the language in some of the items to make it more user friendly. For example, changing "leader/head of department" to "principal/SpEd director" in this item: "My school leader/head of department is a good example of an effective data user." Or adding 'hardcopy, student folder' phrase in this item: "I have access to student data in an information system."

I also added an introduction that explains the purpose of the survey and the terms that were used throughout the survey such as "data use" to make sure that teachers understand what survey questions mean.

Dispositions Survey

Dispositions Survey (see Appendix A) was adopted from the Prenger and Schildkamp (2018) study. The survey is a five-point scale survey in which participants can respond to items by selecting one of five options: completely disagree, disagree, neutral, agree, completely agree. The survey consists of 8 parts: collective efficacy (to what degree teachers believe their school is capable of data use), self-efficacy (to what degree teachers believe in their data use skills), perceived control (the degree to which teachers feel the autonomy for data use), affective attitude (teachers' emotions arising from data use), instrumental attitude (teachers' beliefs about likely consequences of data use), subjective norms (teachers' beliefs about expectations of other people), intention to use data, and data use for instruction.

Prenger and Schildkamp (2018) developed the scale for six of the psychological characteristics (affective and instrumental attitude, subjective norm, perceived control, self-efficacy and intention) based on the Teacher's Conceptions and Practices of Formative Assessment Questionnaire by Yan and Cheng (2015). Participants were asked to rate each item of the psychological scales on a five-point Likert-type scale, ranging from 'strongly disagree (1) – strongly agree (5)'. For the response scale for 'Instructional data use' the response category of 'neutral' was removed. These items ask if people do or do not use curriculum assessment results for different goals; the term 'neutral' is meaningless here. This resulted in a four-point scale ranging from 'strongly disagree (1) – strongly agree (4)'. The Cronbach alpha coefficients for the survey categories ranged from 0.69 to 0.94 (Prenger & Schildkamp, 2018). The original survey and the reported Cronbach alpha coefficients for survey categories can be found in Appendix A. The survey has 47 items, and the score range is 47 to 235.

Since the current study explores individual teachers' experiences with data use, I removed the "Collective Efficacy" category from the original survey. This category assesses teachers' efficacy for data use in a team of collaborators, and specifically designed for a study that worked with data teams. I also changed some of the language of the items to make them user friendly and also more inclusive. For example, I changed the item "Identifying weak students" with "Identifying students' needs." The Dispositions Survey was administered adjacent to the Data Use Survey.

Semi-structured Interviews

I used semi-structured interviews with participants to uncover each teacher's daily, weekly, monthly, and annual routine toward data use for instructional purposes. During this interview, participants were asked to respond to questions (see Appendix B for interview questions) regarding their data use routines such as questions about teachers' data resources, how frequently teachers use data, how they decide whether a student is making progress toward their IEP goal, how teachers set their goals, how teachers make instructional changes, and how they collect student data.

Procedures

Recruitment

I intended to use Snowball sampling (for details see Parker & Scott, 2019) to recruit special education teachers. However, the recruitment proved to be more challenging than expected to carry on a complete snowball sampling process. Recruitment happened in four phases. In addition to Snowball sampling, I also employed theoretical saturation where I stopped recruiting new participants when there was no more new data added to the previous interviews.

In Phase 1, I contacted the MN Association of School Administrators (MASA) to introduce this study and request a list of email addresses of special education directors or administrators. I received a list of special education directors who work in the state of Minnesota. Twice a week, I randomly selected five email addresses from the list and sent a recruitment email. The recruitment email included an introduction of myself (as

researcher) and the study, the request of forwarding the email to special education teachers, and a link to online surveys for special education teachers who would like to participate. Initially, I sent emails to 12 different special education directors and only 2 of them responded to my email by saying they forwarded the email to teachers. I also sent a reminder email to the 10 directors who did not respond to my first email. After reminder emails, again I did not receive any response from them.

When there was not a lot of response from Phase 1, I initiated Phases 2 and 3. In Phase 2, I asked all of my personal contacts to forward the recruitment email to any special education teachers they know. In Phase 3, I contacted special education directors from a project I worked on previously. The number of participants who filled out the survey was still less than expected. Hence, I initiated Phase 4 by creating a recruitment post on my personal Twitter account. I also asked my personal and professional contacts to share the same post on their social media accounts or share my recruitment request with their personal contacts.

Throughout the recruitment process, I also asked every teacher that I interviewed to share the study with their colleagues. The process lasted from late October 2022 to middle of January 2023.

Delivery and Completion of Surveys

Special education teachers who received my recruitment email or saw the recruitment posts on social media platform clicked the online survey link included in the email or the post. The link took them to Data Use and Dispositions Survey powered by

Qualtrics (an online survey platform). Teachers who completed the survey also entered their email addresses in the survey. From the middle of October 2022 to the end of January 2023, I checked the Qualtrics website to track teachers' survey completion every day.

Interviews

Participants shared their email addresses when they were filling out the survey. Upon completion of the surveys, I reached out to teachers to schedule a time for a remote interview over Zoom. Interviews were semi structured, meaning I had a set of questions to ask teachers, but I also added more questions during the interview based on the participants' responses to my questions. For example, if I did not understand what teachers meant while explaining their data use practices, or how they used a specific measurement tool, I asked more questions to make sure that I understood what they were explaining.

Interviews were recorded over Zoom. I uploaded audio files of each interview to an online transcription tool called Trint. Trint transcribed audio files into text. I reviewed each text and corrected any typing errors while listening to the audio. Last, I downloaded the final text as a Word Document to do qualitative coding.

Data Analysis

Descriptive Statistics

A summary of which resources were used to answer research questions can be seen in Table 1. I used the data use and dispositions survey data to conduct descriptive

analyses presenting means, standard deviations, minimum and maximum of the psychological factors of teachers. Descriptive statistics were used to answer research questions 1 and 2.

Table 1

Research Questions and Data Sources Used to Answer These Questions

Research questions	Data Use Survey	Dispositions Survey	Semi-structured Interviews
1. What are the perceptions of teachers toward collecting progress monitoring data and using the data for creating individualized instruction for students who are not responding to the current practices?		X	X
2. What types of data do teachers collect and use for individualizing instruction, and how do teachers use the data to inform instruction?	X		X

Qualitative Coding

Interview transcripts were uploaded to Nvivo (a software program for data management and analyzing qualitative data) for qualitative data coding. Coding for grounded theory research consisted of 3 stages: initial coding, intermediate coding, and advanced coding. Charmaz (2006)'s approach was used during data analysis.

Initial coding is an open coding process where the researcher does not impose preexisting categories, but rather explores what the data provides. Initial coding involves categorizing and assigning meaning to data by labelling the lines or phrases (Chun Tie et al., 2019). During initial coding, I started by reading the transcripts line by line to

establish initial categories. While I was reading interviews, I highlighted sentences and wrote the assigned initial codes in comments. Then, I copied and pasted these codes to a spreadsheet. I continued to do the same for all interviews. I used the same spreadsheet in intermediate coding too.

Intermediate coding helps to refine codes and create more broad categories by reviewing codes from initial coding and analyzing their interactions (Chun Tie et al., 2019). Charmaz (2006) names this intermediate coding phase as focused coding. During the focused coding phase, I read the initial codes in the spreadsheet and tried to find patterns and commonalities between initial codes to generate more generic categories that reflect the interactions among different interviews. The most frequently observed categories across different interviews were used to create a more comprehensive coding structure. For example, in the initial coding phase, I saw teachers mentioned district-wide assessments at different times during the interview and talked about different aspects of those assessments. Then, I created intermediate codes about district-wide assessments being efficient or a limitation. In the spreadsheet, in the next column of initial codes, I noted the assigned intermediate code.

In the advanced coding phase, theoretical coding was performed to create a theory of the phenomena, ‘data use.’ Theoretical codes were used to specify possible relationships between categories developed during focused coding. These findings in theoretical coding are represented as a set of interrelated concepts, which are integrated into a substantive theory (Chun Tie et al., 2019). I created theoretical codes by identifying how each intermediate code affects teacher data use. For example, district

wide assessment is efficient, and district wide assessment can be a limitation are the two intermediate code which constructed a theme for the final theory called “Districts provide tools that are widely used.”

Privacy and Ethical Considerations

Before conducting this study, I applied for approval from IRB of the University of Minnesota. IRB reviewed this study and decided that it is not a “Human Subject Research,” meaning that the study does not need to get an approval and IRB does not monitor the study.

Since I reached out to participants with a Snowball approach and did not work with a specific school district, I did not go through any research application process with school districts. However, I still made sure that participation in this study was voluntary and the data from this study would not include any identifiable information of participants. I assigned an ID number to each participant who filled out the survey and exchanged their names with ID number in data. Also, during the interviews, neither I nor participants used participants’ real name, any student name, or school information.

Prior to taking the online survey and conducting interviews, I explained the study and the purpose to all participants. Participants received a $50 e-gift card to thank them for their time. To be able to receive the gift card, participants needed to complete the interview process.

Validity and Reliability of the Study

To establish validity of the study, multiple methods of validation were used. According to Creswell and Miller (2010), validation in qualitative studies should capture three lenses: (1) lens of the researcher, (2) lens of the participants, (3) lens of people external to the study. I used the 'Disconfirming evidence' method to establish reliability from the lens of the researcher. Disconfirming evidence occurs when the researcher searches for counter evidence that contradicts the categories created among codes. For example, when I was reading an interview transcript, based on the teacher's comment, I created a code named "district wide assessment is used for all teachers to progress monitor". Then later in the interview, I realized that the teacher was not using the district's assessment for all students. She preferred to use other methods to progress monitor for her students who have lower level of reading skills. Then I went back to the first code and changed it to emphasize other aspects stated by the teacher in the same comment such as "district wide assessments are easy to use".

Then, I shifted the validity process from researcher to participant and conducted 'Member checking.' Member checking means taking data, codes, and interpretation back to the participants and asking them to confirm the interpretations (Creswell & Miller, 2000). After completing the initial and intermediate coding of the interview transcripts in Nvivo, I created a Word document for each participant to member check. In this document, I included a brief introduction explaining what a member check is and how they should navigate the document. Then I added an example of how member checking work. Then I added 3 codes in each document. For each code, I wrote the code name

(such as “Teacher Choice”), the definition of code (i.e., what the code means), and finally I added corresponding teacher’s comment which was coded under that specific code.

While creating member checking documents, I used Nvivo’s data analysis features to make list of codes with an order from the most frequently referenced code to the least frequently referenced code to decide which codes I should include in the document. I proportionally selected 3 codes from this list. For example, “teacher choice” code was the most frequently referenced code, so I included this code to the member checking documents more often than 2nd most referenced code.

Out of 10 participants, 6 of them responded to member checking documents and they all agreed that the codes I assigned their comments correctly represent their comments. Hence, I did not make any changes to the coding after member checking.

In the last validation step, I used ‘Peer debriefing’ for validity through the lens of external people. According to Creswell and Miller (2000), this method is best when it is used throughout the study. Since initial coding and intermediate coding phases were intertwined, I completed peer debriefing with an external peer reviewer (someone who is familiar with the phenomenon) after I finished creating the initial and intermediate codes. I met with the peer reviewer and explained to her the purpose of the study and my coding process. Then, I went over the codebook to describe my coding scheme. The peer reviewed the codes and categories, and asked questions or provided feedback about methods and interpretations.

Then, I provided two interview transcripts and a codebook that includes definitions of intermediate codes, names of intermediate codes, names of initial codes and some coding examples. The peer tried to code the transcripts by herself by using the codebook. Intercoder agreement (ICA) between the peer's coding and my coding was κ=.5 (Cohen's Kappa). Majority of the disagreements were caused by lack of clarity for the extent of code coverage; meaning that the peer was not sure if some comments identified under a code category. The disagreements were resolved and I revised the codebook by adding more explanations and examples for codes. To make it more clear and understandable for audience, I revised the explanation of two codes and changed the name of one code after discussing the codes with her.

At the end, the peer reviewed the final Theory and shared her reflections on that. Overall, the peer agreed with the coding process, the naming of codes and code assignments to the comments in those two transcripts shared with her.

Positionality Statement

As the researcher of this study, I am a PhD Candidate who specified her work on special education teachers and data based decision making. I have worked with special education teachers for 4 years to improve their use of data based instruction skills. I collected both student and teacher level data for years. I previously interviewed special education teachers about their use of DBI in writing to find how much they sustained using of DBI framework after the removal of PD support. It is likely that my previous experience with special education teachers influence my interpretation of data.

Chapter 4

Results

The purpose of this study was to explore how teachers engage in DBDM for students who need individualized instruction and to investigate teachers' data use experiences. The study was guided by two research questions: (1) What are the dispositions (attitudes and perceptions) of teachers toward collecting progress monitoring data and using the data for creating individualized instruction for students who are not responding to the current practices? and (2) What types of data do teachers collect and use for individualizing instruction, and how do teachers use these data to inform instruction?

Research Question 1: What Are the Dispositions of Teachers Toward Data Collection and Data Use for Individualization of Instruction?

All teachers who volunteered to be part of the study completed the Data Use and Dispositions survey by clicking a link they received. This survey included questions about teachers' data use practices and their attitudes and beliefs about data use. Table 2 shows teachers' responses for characteristics of data, user (teachers themselves), school, and collaboration for data use. Data characteristics items were about the data itself such as availability or quality of data. User characteristics items were more about the teachers, and how they are able to use data or confident about data use. School characteristics items aimed to identify the perspectives at the school or administrative level. Lastly, collaboration characteristics items aimed to identify the level of collaboration for data use.

Teachers responded to these questions by selecting how much they agree or disagree with the items. The higher the scores, the more positive were teachers' attitudes toward and confidence with data use. Based on participants' responses to these items, school characteristics have the most variable category among teachers. The scores gained in this category ranged from 12 to 58 with a mean of 46.3 (*SD* = 13.1), indicating that, overall, teachers in the study reported positive attitudes at the school level toward data use, yet this experience varies across different teachers. This variation may reflect that teachers have a variety of data use experiences at different schools; some teachers have more positive collaboration experiences and more support at the school level, whereas others have much less positive experiences at the school level.

Other categories in Table 2 have high mean scores and less variability, meaning that overall, all teachers in this study reported higher positive data use experiences in terms of data characteristics such as accessing data, user characteristics, and collaboration.

Table 2

Characteristics of Data, Teachers, School, And Collaboration for Data Use

Category	**Mean (SD)**	**Min**	**Max**	**Example**
Data Characteristics	36.6 (4.3)	29	43	"I have data on the progress of my students", "The data I have on my students are up-to-date"

User Characteristics	28.9 (2.3)	26	32	"I am able to adjust my instruction based on data", "I am comfortable in interpreting data that are presented in graphs"
School/Organizational Characteristics	46.3 (13.1)	12	58	"My school leader/head of department is a good example of an effective data user"
Collaboration	8.5 (1.4)	5	10	"I share and discuss the results of my students with other teachers"

Note. N=10. The maximum scores can be gained from each category in the survey are 44, 32, 64, and 12 respective to the order of the categories listed in the table above.

Table 3 below shows teachers' dispositions toward data use. Similar to the previous part of the survey, higher scores indicate higher efficacy, or more positive attitudes toward data use. Overall, teachers reported high levels of self-efficacy, perceived control, affective attitude, selective norm, and intention to use data.

Table 3

Dispositions of Teachers Toward Data Use

Category	**Mean (SD)**	**Min**	**Max**	**Example**
Self-Efficacy	40.2 (3.1)	36	46	"I am able to analyze data", "I am sufficiently skilled to use data"

Perceived Control	8.9 (1.7)	7	12	"I can decide for myself whether I will use data or not"
Affective Attitude	25 (1.9)	22	28	"In my opinion using data is a pleasant process"
Instrumental Attitude	31.4 (3.5)	25	35	"Data use can help improve student achievement"
Selective Norm	7.2 (3)	0	12	"I use data because the head of my school considers this as important"
Intention	14.9 (1.6)	12	16	"I am planning to critically reflect on my teaching practice based on data"

Note. N=10. The maximum scores can be gained from each category in the survey are 50, 12, 28, 36, 12, and 16 respective to the order of the categories listed in the table above.

Research Question 2: What Types of Data Do Teachers Collect and Use for Individualizing Instruction and How Do Teachers Use these Data to Inform Instruction?

Teachers' responses to both survey and interview questions revealed data sources they use, the frequency of their data collection and use, and the purposes for which they use data. Interview questions included one specific question about the data sources teachers have used. Additionally, teachers also revealed what they consider as data sources while they responded to other interview questions as well. Their comments revealed teachers' data sources and identified what they categorized as student data.

Table 4 shows teachers' identified data sources, including both the assessments prescribed by the school or district and also other forms of data sources that teachers chose to collect.

Table 4

Participant-Reported Data Sources for Progress Monitoring and Decision Making

Teacher	Content Area	Programs/ Assessments	Frequency of PM	Other Data Sources
T1	R, W	Curriculum-based Measurement (CBM) reading assessment FastBridge Orton Gillingham CBM writing probes	Every week	Observations
T6	R, W, M, S	CBM AIMSweb PRESS CBM Math KTEA	Every week	Observations Anecdotal notes OT evaluation Asking comprehension questions
T7	R, W, M, S	PRESS AIMSweb	Every other week	F-Form (a form teachers report on student data, progress, and instructional changes) Observations Notebook of anecdotal notes
T3	R	FastBridge CBM	Monthly	Observations
T4	R	FastBridge Orton Gillingham SIPPS Curriculum	Every week	Student notebooks
T8	R, W, M, S	AIMSweb PRESS	Every week	Observations
T9	R, W	FastBridge	Every other week	Alphabet checklist
T20	R, M	Easy CBM Acadience	Every week	Post it notes Error tracking
T21	R, W, M, S	AIMSweb IReady	Monthly	Observations Student work Notes
T22	R	DIBELS Teachers College Reading and Writing running records	Every 3-5 weeks	OT metrics SLP metrics Spelling tests Form filled by teachers for reflecting on progress End of unit assessments

Note. R= reading, W= writing, M= math, and S= science. Frequency of progress monitoring was listed under Frequency of PM column. Numbers in ID names of participants represent the order in which they participated to the study. For example, T1 is the first teacher who completed the survey and participated to the study. For more details, see Deno (1985) for CBM; Gillingham and Stillman (1956) for Orton Gillingham; Kaufman and Kaufman (2014) for KTEA; Howe and Shinn (2002) for AIMSweb; Good et al. (2004) for DIBELS; Bondus (2018) for SIPPS; Burns et al. (2015) for PRESS; Good and Kaminski (2011) for Acadience; Jones (2013) for I-Ready; AIR(2021) for Teachers College.

Table 4 shows that all participants reported teaching reading and monitoring students' reading progress, while fewer teachers reported teaching and monitoring writing and math. Even though four teachers reported teaching science, during the interview, they did not explain whether they progress monitor for science.

Curriculum based measures (CBM), FastBridge, and AIMSweb were the most frequently used systems and assessments among teachers. The majority of participants collected progress monitoring data weekly, whereas some of them did so biweekly or monthly.

Over half of the teachers reported using observations as data source for progress monitoring or decision making. Mainly teachers reported using observational notes to make decisions or relying on direct, in-the-moment observations to decide student performance. Other data sources teachers reported using for evaluating student progress and instructional decision making included: students' work, students' responses to comprehension questions, some forms for reporting teacher reflections, tests created by teachers, and Occupational Therapy or Speech Language Pathology metrics.

In addition to the data types teachers collect and the data resources they use for decision making, I gathered more information on teachers' data collection practices to

gain more information on how teachers use data. Teachers reported how frequently they use data for different purposes when filling out the Data Use survey. Teachers' responses to some items in the survey revealed information on how frequently teachers engaged in data use for individualizing and adjusting instruction. Table 5 shows the percentage of teachers who reported their data use frequency for different purposes. Two items (with an asterisk; see Table 5) directly asked how frequently teachers use data for individualization: 'tailor instruction to individual students' needs' and 'adapt instruction based on the needs of struggling students.' Half of teachers reported using data more than once to tailor instruction based on individual students' needs whereas 80% of them reported using data more than once a week to adapt instruction for struggling students.

Table 5

Percentage of Teachers Who Use Data for Different Instructional Purposes

Frequency Purposes	Never	Once or Twice in a year	Once in every 2-3 months	Once in a month	Once in a week	A couple times in a week
set learning goals/targets for individual students	0%	20%	30%	30%	20%	0%
determine which topics and skills students do and do not possess	0%	10%	30%	20%	20%	20%
determine progress of students	0%	0%	0%	40%	50%	10%
*tailor instruction to individual students' needs	0%	0%	0%	10%	40%	50%
set the pace of my lessons	0%	0%	0%	0%	40%	60%
give student feedback on their learning process	0%	0%	0%	0%	30%	70%
form small groups of students for targeted instruction	10%	0%	30%	10%	20%	30%
identify instructional content to use in class	0%	10%	10%	10%	50%	20%
study why students make certain mistakes	0%	0%	0%	0%	70%	30%
adapt instruction based on the needs of gifted students	60%	0%	0%	20%	20%	0%

*adapt instruction based on the needs of struggling students	0%	0%	0%	0%	20%	80%

Note. N=10. Items with asterisk (*) asks directly about individualizing instruction.

To understand how teachers use data better, during the interview, I asked participants about what they do after they collect progress monitoring data and what changes they make to their instruction if they need to make any change. The types of changes were extracted from the interview transcripts and listed in Table 6. Providing more opportunities to practice, reteaching the skill, and providing more one-on-one support were most frequently reported instructional changes. Other changes included environmental changes, providing behavioral or motivational support, incorporating games or activities, regrouping students, changing the intervention, and changing the time of the intervention.

Table 6

Types of Instructional Changes Made by Teachers Reported During Interviews

Teacher	Types of Changes
T1	Incorporating sensory approach, tactile work
T3	Environmental changes (Changing seat location) Regrouping students Adding visuals Removing some parts of instruction More one-on-one Behavioral support Reteach
T7	Incorporating some practices found in a book
T3	Switching to another intervention Untimed assessments Reteach
T4	Integrating games More opportunities to practice
T8	Motivational support More one-on-one Adding more Tier 3 support Changing the time of the intervention before or after lunch
T9	More opportunities to practice Reteach

T20	More one-on-one Guided practice
T21	Adding more intervention time More one-on-one Reteach Integrating different activities More opportunities for practice
T22	More opportunities for practice Environmental accommodations Sharing instruction content before lesson

After extracting information on the frequency of progress monitoring, data types, data resources, and the types of changes teachers made, I used a qualitative data analysis approach to analyze the interview data. My aim was to create a theory based on data which explains how teachers use data. In the following section, I explain the initial and intermediate coding procedures done to develop themes. Next, I explain each theme that emerged from the coding procedure in detail. Last, I propose the theory and explain how the theory works.

Initial and Intermediate Coding

In grounded theory research, theory is generated from the data. In this study, I followed Charmaz's (2006) three-step coding approach to analyze the data and generate a theory. Through the initial coding, I developed 47 categories (shown in Table 7) to describe comments that teachers made in response to the interview questions. These categories were created by thinking about how these comments reflect teachers' data use practices. During the initial coding, I created categories by highlighting sentences and adding comments on each transcript in Word.

Table 7

Initial and Intermediate Coding Phases

Initial Codes	Intermediate Codes	Themes
1A Systematic data collection 1A Easy to use 1A Presents data and graphs 1A Shows errors 1A Easy access 1A Easy to share 1A Answer key	1A District wide assessments (DWA) are efficient	1 Schools and districts provide tools that are widely used
1B No money for other assessments 1B Do not fit all students	1B DWA give little space for other assessments	
2A Teacher adjusts DWA baseline benchmarks 2A Teacher uses extra screeners 2A Teacher uses formal and informal data	2A Integrating multiple data sources for decisions	2 Teachers' understanding of data and their practices impact the data use
2B Teacher talks about data with others, including students	2B Talking about data	
2C Teacher uses data for adjusting instruction	2C Individualization	
2D Teacher is confident about data they have	2D Confidence in data	
2E Teacher changes format of assessment 2E Teacher defines the frequency of progress monitoring 2E Teacher defines the frequency of decision making 2E Teacher determines what sets progress 2E Teacher determines which assessment to use 2E Teacher plans a way for data organization	2E Preference	
2F Graph interpretation 2F Rules to determine "no progress" 2F Checking behavioral needs and other external factors when sees no progress 2F Error Analysis 2F Percentage Accuracy	2F Data analysis	
3A PD on DBDM 3A PD during Masters' 3A PD on DWA 3A PD received in previous job 3A learned themselves	3A Professional development received	3 Teachers received different levels of professional development
3B not enough 3B no formal PD 3B more PD needed for new teachers	3B Professional development is not enough or needed	

4A Decision making team work together 4A Teacher discuses with other teachers 4B Teacher work with parents to create more opportunities for practice 4C Limited collaboration due to position 4C Targeted team of teachers needed 4C Structured meetings needed 4C Support from other staff is needed	4A Collaboration with other teachers 4B Collaboration with parents 4C More support and collaboration is needed	4 Collaboration is an important yet lacking component
5A Some curriculum has built in assessments 5B Reading has a variety of assessment and instructional programs targets every subskill 5C Limited assessment for math 5C Limited assessment for writing 5C No formal assessment for comprehension 5C Teachers try to fill with informal data when assessment are not available	5A Built in 5B A variety of options 5C Lack of resources	5 Resources varies across schools and content areas

Note. DWA stands for District Wide Assessments and the term was used to represent assessment provided and encouraged to be used by the school district. Initial codes in the first row are all associated with DWA.

In the second phase of analysis, I created a separate spreadsheet in which I copied and pasted the initial categories from the Word documents, then started to identify the patterns among the initial codes and group similar codes together. After grouping similar codes, more focused codes were created. These focused codes are called intermediate coding. The second phase revealed 16 intermediate codes as shown in Table 7.

Theory Development Example

Based on the categories identified during intermediate coding, five themes evolved that explain the context of teachers' data use: (1) Schools and districts provide tools that are widely used, (2) teachers' understanding of data and their practices impact the data use, (3) teachers received different levels of professional development, (4)

collaboration is an important yet missing component, and (5) resources vary across schools and content areas.

Schools and districts provide tools that are widely used theme emerged from two categories: (a) district wide assessment (DWA) are useful, and (b) DWA are limited. The first category was created from a variety of initial codes which represent the comments about why teachers use the DWA and what they think about using them. During initial coding, I highlighted each sentence in which teachers talked about DWA and assigned an initial code based on what teachers said. The initial codes included easiness of accessing data, sharing data with others, having answer keys, checking errors, doing assessments, and graphing the data. In the next phase, I looked for the patterns between initial codes to create intermediate codes. I realized that the initial codes were focused on the usefulness of DWA. Hence, 'DWA are useful' became the intermediate code.

Another intermediate code is 'DWA are limited.' Even though DWA are widely used and very efficient assessments, during initial coding, I found comments that expressed the limitations of DWA. Some teachers mentioned that DWA is good but not enough to diagnose the areas of need for all students. And schools do not have DWA for all content areas such as writing or math. The patterns between comments about limitations led to the focused intermediate code of 'DWA are limited.' In addition to the usefulness of DWA and their limitations, all teachers mentioned generally using DWA because it is provided by the district and teachers were asked to use it. Hence these categories led to a theme that describes one role of schools and districts in data use: *Schools and districts provide tools that are widely used.*

Explanation of Themes

Theme 1: Schools and Districts Provide Tools That Are Widely Used. All interviewed teachers shared that they were provided some sort of assessments from their schools and districts, and they all use these assessments for setting IEP goals or for progress monitoring. Schools encourage teachers to use the same assessment tool for a variety of reasons. When asked about how they determine which assessment to use, one teacher replied with:

> We kind of, as a department, decided that they wanted everyone to be progress monitoring and, a FastBridge, just because the kids are tested in FastBridge and in the fall and in the spring. And so that's what the district has decided.

Even though this is one teacher's comment, I encountered similar comments in other teachers' interviews too. Some schools wanted this kind of unity to have clearer communication and understanding of data across the school. For example, another teacher replied to the same question with more reasoning by including how they wanted everyone on the same page:

> So there are things that we want to be common, like we want everybody to use the same assessment system for their running records, because if you use different systems, then they don't align. And it's not accurate of measuring growth because you're using different systems.

Some schools had a specific targeted area and encouraged their teachers to collect more regular data from students. Teacher 7 (T7) explained that their school has a focus on

improving reading achievement of students and at the school level all teachers are required to report data every month. This requirement led T7 to consistently collect reading data. She also mentioned a form in which teachers reflect on their practices and provide reasoning for their data-based decisions monthly:

> So there's a goal that our whole school has as far as reading is concerned. And then every month I need to put in the data into September, October, November, December, January, all the way through May and then. So that's one of the things that I have. And then I also need to fill out this form F, kind of my reflections and what am I doing differently and is it working? Is it not working? What am I doing to try to meet these goals? And the goal the goal has to do with.

Then she added more information on how frequently she checks data for math and reading:

> So one [academic area] every other week. So one week I look at the math. One week I look at the reading because I need to look at the graph and I need to plot, you know, the data's in there. And then when you just put it up and I also need to do put it in my form F for November, right? So I'm not going to lie. I look at my reading a lot more than I look at my math because I have to put in that [F form]. I have to put in the data into my reading goal thing for December.

Having schools and districts push for using a specific assessment system has its advantages and disadvantages. The majority of the teachers found DWA easy to use and they referred to their efficiency often. When a school or a district uses the same

assessment for all students, it allows for keeping a data record for every student. Hence, when students move from one room to another, or when they start receiving special education services, teachers can easily access their academic data history. Teacher 9 (T9) explained why she liked using the DWA, commenting:

> So yeah, I use FastBridge and that rating thing because that's what as a district we use. So I know we're already all set up for it. And sometimes before the kids are even in special education, they've been assessed through the FastBridge and monitored that way. So then it's easy to look at their data and everything. So I guess that's I use that because that's what we as a school in a district use.

In addition to easy access to data and generally liking the use of DWA, some teachers specifically mentioned how progress monitoring graphs provided by these assessments made checking student progress easier for them. T7 commented that:

> So you can, it [DWA] automatically puts in like summaries and graphs. You make a goal for each of the students based on how they did initially. And then you can see every week how they're doing and if they're lining up and if they will reach that goal at the end.

Teachers appreciate not only graphs but other forms of data too. When asked about whether the assessment system provides automatic data visualization, T1 replied with:

> Yes, it's in a, it's in multiple formats. But yeah, the progress monitoring like the weekly progress monitoring detail, the beauty of FastBridge is that has lots of different ways to like review and dive into the data.

T1 also commented that this assessment program provides an answer key and also keeps track of errors in addition to the students' accuracy data:

> It [DWA] tells me their reading accuracy, how many errors they had, categorizes the errors based on how I've marked them and then it puts everything and then I'll usually wait for them to finish reading the passage and then we go to the next section and then I'll answer that. I'll ask them the ten questions in the system. It already has answers provided. So like I don't have to remember the story necessarily because I'm going through multiple students and they all might be on different passages. So it gives it as it tells you the question to ask the student, and then it gives possible answers, multiple possible answers just based on. So then I use my best judgment to, you know, mark it correct or incorrect. And then at the end of that, again, it'll tell me they've gotten seven out of ten or nine out of ten and I click submit and it puts everything into a beautiful graph.

Overall, many teachers shared their positive thoughts about using DWA; however, there were other instances where teachers commented how DWA can be a limitation for their data use. T7 explained that their school uses a system called PRESS for reading and how this system aligns with the school's tiered support model. This teacher liked the opportunity to be trained by experts and having a system for reading; however, she thought that the system was not suitable for her student population:

> So part of it for me was like, my students are nonverbal. Like, how can I adapt this test to make it equitable for them and to really help them to see what they know?

Although the schools and districts encourage the use of the same assessments, it seems that these assessments may not meet the needs of every student. T3 also commented about the lack of alignment between the computer assessment and her students' needs:

> I knew that that computer data was not accurate because he was a kid that would just like, you know, you know, sit and just answer. And so when I did it with him, he again scored higher. But it was again, you had to remove all the distractions and do it one on one. And so a lot of times it's me having to redo it one on one with the kid.

Even teachers who use DWA for most of their students may need to look for other assessments for some students. When asked about how they determine students' performance level, and whether teacher uses DWA, T1 commented:

> Sometimes, Yes. Not always FastBridge specific. I use the FastBridge Assessment System and if they are not able to progress in that system, then we will reach out to other curriculums.

Another limitation that widely used DWA brings is that investing in one assessment system limits a school's resources to purchase alternative assessments when necessary. As part of the interview, teachers were asked whether they are confident with the assessments they use and if they have freedom to choose alternative assessments. Even though many teachers were confident and happy with the prescribed assessment by schools, some of them mentioned their limited ability to access all assessments because

of not having enough resources. When asked if he can choose to use other assessments if he wants to, T6 clearly and openly shared that:

> I think I could. I could, but then I wouldn't have the resources to purchase those things or access them. So. So if I wanted to choose one, I could. But I would have to come up with those financial resources.

Having limited resources for purchasing assessments also appears in private schools. T22 was a special education teacher and a director of support services now at a private school. She shared that they use DIBELS tests for progress monitoring, yet they record results somewhere else to analyze themselves. She commented that:

> So DIBELS, so Acadience bought out DIBELS. And if you have a subscription to Acadience, you can enter all that information into their program and it'll keep it. Because we're a small private school, we don't have the money to pay for that. So I just created my own database.

It appears that schools encourage using the same assessment systems and they provide resources to purchase these systems at a different level. In a very unique case, T21 shared that their school does not use an assessment system and let their special education teachers to do what they want. However, this created a problem, because when asked about why she chose to use EasyCBMs, she replied with:

> I chose this because you can get an individual account. That was another piece of it. Um. You can't get an individual account of AimsWeb, otherwise I would have.

***Summary of theme*.** In summary, teachers were provided district wide assessments by their schools, and overall they found these assessments useful and efficient. Specifically, teachers praised these assessments' abilities to provide automatic graphs and data analysis, their accessibility, and easiness to use. Having unity in assessment within a school district provides a lot of efficiency; however, it also brings some limitations to spending resources on other assessments when teachers determine that existing assessments are insufficient.

Theme 2: Teachers' understanding of data and their practices impact data use. This theme emerged from multiple intermediate codes: (a) integrating multiple data resources, (b) talking about data, (c) individualization, (d) confidence in data, (e) preference and (f) data analysis.

Integrating multiple sources of data. Participants responded to questions about how they determine students' end of year goals, or how they determine whether students are making progress. When explaining their practices, the majority of teachers mentioned using different kinds of data sources to know their students' present level of performance, and from there they decided the end of year goals. Teachers have access to benchmark data from their states or from DWA they use. For some teachers, having students screened with DWA and determining where they fall in the benchmark data is not enough. Teachers integrate other sources of data by administering additional screeners or using observational data to decide their students' performance levels and goals. T1 commented about how she determines her students' end of year goals, or their IEP goals:

> How I determine IEP goals for students in reading and writing is typically I'll take their baseline data on their district wide assessments and adjust accordingly.

Then she added more to explain how she is adjusting:

> So I take that data and then I will do some screeners based on where they're at with that data. So if they're reading if they're let's just say they're in third grade, I have some third graders right now that are reading at a kindergarten level. My screeners would be lower at more of a kindergarten level to see what they're able to do competently and quickly. And then we build from there.

Later when T1 responded to the question about determining progress, she said:

> We're collecting important bits of information that are going to help us best service this child's needs. So along with the more formalized weekly progress monitoring data, there's a lot of informal data that goes into play.

In these three comments, T1 illustrates how she integrates different data sources to make a decision. Similarly, T2 also explained how they determine goals for their students:

> How we determine, well, one based on three [year] annual evaluation and then their progress report is based from previous times, and then we use a screener for math and reading that kind of gives us their comparison on the national benchmark and then. Using like curriculum based measurement as well. And then we do have some diagnostic assessments we do for kids who are above it, who are like a Tier two or Tier three risk level on some of the screeners. So like on, for instance, on the AIMS Web reading assessment, like we'll get something like their

> Tier two and Tier three risk. And then we'll do like a PRESS assessment with them to get more of a diagnostic idea.

And she added:

> Also just kind of even just with all that, we also kind of just look at what are they struggling with, what are we seeing? They're struggling with just kind of anecdotally as well, but not as a sole basis.

Some teachers not only value formal data that comes from DWA, but also other informal data they collect every day through observations and anecdotes. When commenting about how she integrates formal and informal data, T21 described the value in informal data:

> So I start with the formal data to write the IEP goals, and then when I'm writing the student's present level of performance on their IEP, that's where I really feel like I can integrate my informal assessment data based on assessments we've done in class or based on my observations of the student. And that's where I can kind of write a nice narrative that includes both the work that the students are doing and their strengths as well as the formal data. And I really feel like my informal data is more helpful for especially for identifying the student's strengths first, because a lot of times the formal data will show you the deficit, what they're not mastering, and my informal observations and student work samples can kind of supplement that and show this is where the student has strengths and where we

> can build on that while we're addressing areas that they haven't mastered yet. So I feel like that the informal data is really helpful.

Talking about data. During the coding process I found another pattern across teacher interviews that some teachers do "data talk" with other colleagues, with students, or with parents. For some teachers, these data talks are more structured with "data team meetings," whereas for others, it is more of an irregular or casual conversation about student data. For instance, T20 commented about data talk with her education assistant with:

> And so we do talk about that. It's not something we really graph, but it is kind of in the weekly conversation.

On the other hand, at some schools, teachers have chances to talk about data with their colleagues on a regular basis. T1 described their experiences by saying:

> We've had FastBridge now in our district for three years and oftentimes on our learning team, we will spend that day, that morning kind of diving into the data to try to look at. Even for our special ed students like specific interventions that would be most beneficial for students that we're servicing in a small group setting.

Clearly in these team meetings, teachers talk about students' progress, they look at data or graphs, and they try to come up with ideas to improve progress for those who need extra support.

Some teachers talk about student data not only with other colleagues but also with their students. For T1, data talk with students is a part of their regular data collection.

When asked about what she does with the data after collecting it, she explained her ritual and also emphasized the talk she does with students:

> The student sits with me and we talk about where what their goals are, that their goal, the goal that their parents and their teachers put together for them. And we work. So before they read, they know what their goal is. They know it where they were at last week. We review the data and then we work towards increasing their progress and sometimes they'll go up and sometimes they'll go down. But we have an open conversation about the fact that some of the passages are harder than others, and it's normal to have some ups and downs as long as we're continuing on an upward trend. So I'm a big believer in making sure that the students understand their goals and that they have visibility to their goals.

Individualization. On the contrary of how widely district wide assessments are used by teachers, and even though many teachers were found to integrate multiple data sources for decision making, there are only a couple of teachers who mentioned using data to individualize instruction.

T1 is one of the teachers who used the word “individualization” when answering questions about what she does with the data and added more details on how she does it:

> [I] individualized the instruction to the child that's not progressing. So if they're like, for example, Sonday, the Sonday reading system is very structured and systematic. It's meant to follow a sequence so that you can build on your skills. And if a let's just say I have three kids in a group. Two of them are progressing as

> expected and one is not. I will continue to work on the mastered skills with the two children who have, you know, who are demonstrating that they're able to progress and then and challenge them at that level while I'm trying to get this other one up to speed. So that may be reviewing the lesson, incorporating some different sensory input into the lesson. It's a multisensory approach.

Other teachers rarely mentioned the word “individualization” during their interviews. But I counted phrases such “adjusting instruction” or “making changes” when teachers explained what they do with the assessment data as individualization. For example, T7 used the word “changing” in the context of making instructional changes when asked about what she does with data:

> Although now, you know, I'm, I look at the data from my biweekly data and so we're changing I'm changing what I'm doing with the two third graders now based on how well they're doing with the letter recognition.

Then she added that having fewer students in her class makes it easier to make decisions at the individual level:

> I'm fortunate in that my class size is small enough to be able to individualize depending on where they're at. And I have many opportunities for them to come up to the board and for the you know, I mean, I'll call them the littles and the bigs, right?

On the other hand, T22 responded to the same question slightly differently. When asked about what they do with assessment data, she explained two levels of

individualization happening at their school. A data team gets together and talks about classroom level data, then they talk about individual student data if they see outliers in classroom level data. To clarify whether they look at individual student data and make adjustments at the individual student level, I asked a clarification question. She replied:

> It can be individual students or it can be like trends that we're noticing. So, for instance, you know, the second grade we talked about how they need to work on comprehension. Then one of our learning specialists can meet with the second grade team and give ideas about how to boost that instruction within the classroom. We also have teachers who have brought to us like concerns about their gifted kids and how to help them extend their knowledge.

Confidence in data. Teachers were directly asked how confident they feel about the data they have such as believing the data represent their students' progress, or they can speak about the data with others. The majority of teachers commented they felt very confident about the data they have for their students. Some teachers talked about the confidence in the context of communication with other teachers and parents. For example, T3 explained her confidence with:

> I definitely feel like I like when we have parent teacher conferences. I definitely can speak to that, to the teachers and to the parents. On whether or not the students are making progress or not, and I can give them actual data and show them and be like, this is where your student was at at the beginning of the year. This is where they're at now. And I feel like I can speak to that very clearly and show them using the data that I have.

This comment shows that, for T3, data provides concrete examples about student progress so that she can communicate the information clearly.

Other teachers commented on confidence from a different perspective in which they described how much they feel confident about the data itself. For instance, T8 shared that they had some students having a lot of missing school days, hence she had inconsistent progress monitoring data. When asked about how confident she feel about the data, she replied with:

> Of like actual formal progress monitoring. No, but like, just the regular, like, data we collect, like, throughout the day. That I think is sufficient.

She referred to informal observational data by saying “regular data” in her comment.

Lastly, one group of teachers talked about the confidence from a user characteristics perspective—meaning their ability to handle data. T6 expressed his confidence in data as:

> I feel pretty confident because I've used for two reasons. I've used them in different settings for different types of kids for a few years. And then I've also used other measures before that I didn't like as much necessarily. So kind of seeing that difference too. So I feel pretty confident, um, just seeing it with so many different types of kids in different settings.

Here T6 is more focused on his confidence about using data and he tied this confidence to his experience with it. T1’s comment on confidence takes this perspective on to another step and adds the teaching component:

> I would say that data definitely drives. I love using data in all that I do with my work and I feel more confident as a teacher when I'm able to have data at my fingertips.

As stated in her comment, T1 feels more confident as a teacher because she uses data. It is expected that teachers would have higher levels of confidence with data use and handling data since participation in the study was on a voluntary basis and teachers who were interested in this study were already interested in data use.

***Preference*.** This category is more comprehensive than other categories. In this category, I presented teachers' data use experiences that are based on their choices. These preferences can be seen in the selection of data collection format, measure type, data organization method, or frequency of progress monitoring.

The frequencies of progress monitoring are listed in Table 4. Many teachers collected progress monitoring data every week, every other week, or once a month. The frequency of data collection for progress monitoring was mostly determined by teacher choice. When asked about whether they think the frequency is enough for them to determine the level of progress, almost all teachers agreed that it is enough. School level requirements which ask teachers to report their practices and their students' progress regularly (e.g. F-form example in T7's case) may encourage teachers to progress monitor. However, it is still up to the teacher how much progress monitoring data is being collected in a month. T6 explained his weekly progress monitoring routine and, when asked whether he thinks it is enough amount of data to determine progress, he replied with:

> Yeah. Yeah. Sometimes I think it's even really too much like, you know. For reading, it just depends, like what happens in that week, you know. But if they're having an on week sorry from going too much information but if they're doing a really on week and they're really engaged and participated, I think that's the perfect amount. But if they're having a really off week, you know, there was a couple of days that were kind of a wash because they're having a difficult time. It's almost like not necessary every week. That makes sense. But I just like to keep that system in place.

T9 shared that she does progress monitoring every other week, and replied to the same question with:

> I so far, I think it has been, yes. Yes. Sometimes I'll do like if I like over winter break. Obviously that was a big chunk. So like I did one today, but I think I'll do another one then next week too. Like when there's a big break, sometimes I like to do more than I was doing.

Teacher preference also affected the format of assessments for some teachers. During the interview, I asked "do you think of anything that could make data collection easier" to T1, and she responded that the DWA she uses is very comprehensive and easy to use. However, she also commented that:

> I'll just print the screeners out and do it paper, pencil. But honestly, like, I bring the student next to my desk. They sit in a chair. I give them the binder of the passages that we have, or like the clipboard with the specific 50 words that we're

> going to try to read or sound out today. And then I click the, you know, as soon as they I go through the instructions, they put their finger at the start. You know, as soon as they start speaking, I click the timer they read, you know, I help them with corrections if needed to just keep them going, obviously marking errors while I'm doing that and then the timer goes off and we're done. So it goes pretty fast.

Even though she admitted the DWA is a very efficient system to use, her preference on using paper pencil assessment determines the way she collects data.

For some other teachers, their preference changed the way they manage the data. T3 explained her data storage and management system with:

> So I have two different systems. I have a filing system where I'm filing it, but then I also have a record book where I'm also recording it. And then I have in my record book, I can see a graph, so I'm paper, pencil. Lots of other people are, are computer. I don't, I don't computerize and I just do everything pencil, paper, pencil. But I'm looking to see are they making progress? And I can tell whether or not they're making progress or they're not making progress.

Although keeping track of data manually sounds time consuming, teachers' preference determined the practice.

Teacher preference also has a great influence on their selection of assessment type for progress monitoring. Some teachers reported using DWA to monitor their students' progress and they thought these assessments provide sufficient information. Other

teachers preferred to use other measures or to administer additional assessments. When asked about what she does with the assessment data after collecting it, T8 replied with:

> I don't really use it per se, just because, like, at least for the AimsWeb data collection, it's like it goes from letter ID and letter sounds and then it jumps to like oral reading fluency or like sight words. I was like, there's not really, like that middle ground.

Because her students needed something that would assess the middle ground, she chose to use other assessments available at their school, and added:

> The overall, like AimsWeb data, which is like what we take the most frequently. I don't really use it to guide my instruction.

After describing the types of assessments T6 uses for progress monitoring, I asked how he decided to use them. T6 commented with:

> So AimsWeb, and PRESS were all directed from the school and district. That's, and I do like them anyways, but those were resources provided by the district. And the CBM is just something I decided on my own.

Teachers gave a lot of clues about how their preferences affect what they teach and who they teach as well. For example, when integrating different strategies into her instruction, T1 chose to use a specific system, and she reasoned it with:

> It is research based and they're proven to work. I've had great success with the Sonday system.

T1's understanding of research-based practices and preference to use such practices determined her decision to pick a resource to utilize. T1 also shared that two of her students were diagnosed with dyslexia and dysgraphia, and she commented that:

> Although those aren't two categories that we service students under, I can research and, you know reach out to my teams to find, you know, best practices to help support this child in making sure that [making sure that we're monitoring him weekly, and how we are adjusting his goals, objectives] we're adjusting how we're his goals, objectives and our progress, monitoring him weekly. Because for the past three weeks, he's not made progress.

I categorized this decision as 'teacher' under her preference because she prefers to do research to find best practices for these two students rather than trying to implement the same intervention she uses for other students. Overall teacher preference seemed to play a key role in shaping teachers' data use practice from selection of assessment type to frequency of progress monitoring.

Data Analysis. Teachers shared a variety of different practices of how they analyze data. This category and *Preference* category have similarities for some cases in which teachers' choices determine how they analyze data. However, I highlight data analysis separately because even though many teachers collect data and handle data management, not all teachers engage in data analysis. Also, in most cases, data analysis practices are based on teachers' knowledge of analyzing data rather than their choices. Hence, this part of the data use was considered as a separate category.

Participants of this study commented about whether and how they make decisions based on data at different times during the interview. While some teachers explained their data analysis rules and procedures in detail, others used terminology related to the data analysis which I made inferences about how they analyze data. As mentioned in the previous category, participants had different data management choices; some teachers kept track of data with progress monitoring graphs while others created a spreadsheet of raw data.

Progress monitoring graphs, regardless of whether they were manually made or provided by DWA, were used by some teachers for analyzing data. Teachers who use these graphs shared that every once in a while they check the graphs and look for data patterns. Based on whether they see decreasing trends or increasing trends, they take action. Early in the interview, T1 was asked about how she sets goals for students. She provided a detailed explanation of how she uses data for goal setting and progress monitoring, and also gave clues about data analysis by saying:

> They [students] get progress reports as a part of their IEP, one of which is the annual IEP meeting. And then they get three other progress reports. So I am seeing weekly their progress and if they are not progressing or if we're in a continuous downward trend, then we adjust.

Here it can be seen that T1 uses the phrase “continuous downward trend” which gives implication that the teacher interprets the graphs by assessing a trend line. When asked about what they do with the assessment data after collecting it, T9 also shared similar comments:

> Well, I guess I look at the data to see like I look at the trend to see things I'm implementing during my teaching or helping or not and like how I can. Like, if a kid's not making progress, then I kind of think about what I can change in my teaching to help them make that progress.

T9 also uses the word "trend" which is a feature of progress monitoring graphs. Then she gave more details on how they act when they see one data point off of trend line:

> If there's one, what I will do, if there's one point that's off, then I will. Like I said, I'll do it like three weeks in a row to see. And then if all those three weeks are off, then I know I need to change something.

In case T9 sees an off data point or downward trend line, she stated that she does more frequent assessment and sees if the decreasing trend continues for three weeks or not.

Another method reported by teachers for data analysis is having a percentage accuracy for the targeted skills. Teachers decide whether their students are making progress based on the percentage of accurate responses they get from the assessments. T6 both uses the data storage system from the DWA and a manually-made spreadsheet to keep track of data. Even though for some skills he checks the analysis from the DWA, he reported that he mostly uses his spreadsheet. When asked about how he approaches the data on the spreadsheet to understand the students' progress status, he replied with:

> Yeah. Well, I like to see, um. Like. Mastery about like 95% on something like two or three times in a row, especially for like. Yeah, pretty much for anything.

Then he added that:

> …we definitely want them to have 95% accuracy on something before moving on. So, and I like them to be able to do it independently too with no not queueing or anything like that.

For this teacher, seeing 95% accuracy 3 times in a row is the rule for progress. This is how he assesses the data that he has from his students. Similarly, for T8, accuracy percentage is a rule for progress. When asked about what she does after collecting data, she replied with:

> So, like, all of the goals are like, we'll be able to do like after three consistent days with a certain percentage accuracy. So pretty much like when the data sheets are like full, then like I go through, calculate like their percentages and then if they met a certain objective, then we move on to the next one. And if they haven't met the objective yet and we'll continue working on it and think about like other ways we can like really focus on helping them meet that goal. But I don't have anything like graphs or anything.

Hitting a percentage of accuracy is how this teacher decides whether the students are making progress. From her comment, it can be implied that T8 aligns her data analysis with the goals in students' IEPs. In addition to percentage accuracy, T20 mentioned that they also keep track of errors to make error analysis so that they can find the error patterns and review those needed areas.

For some teachers, how they do data analysis is not as clear as checking trend lines or checking percentage accuracy. For example, T4 explained her progress

monitoring method as keeping student writing or notebooks, and taking notes about the instruction every day. When I asked whether she does anything with these notes and notebooks after collecting them, she replied with:

> Nothing. I keep it like I'll look at it. It's fine. I don't necessarily, like, do anything major with it. I use it for IEP. And so, like, I'll have the kids look at it at the end of the year also. And they usually feel pretty good about that as well. So I sit on it until I need it.

Summary of the theme. A lot of teacher-related factors go into data use practices. The six main categories found from the data of this study are: integrating multiple data sources for decisions, talking about data, individualization, confidence in data, preference and data analysis. Confidence in data seemed to be present for all teachers, even though confidence meant slightly different things for some teachers. Many teachers used multiple data sources when making decisions and when determining goals for their students. What constitutes data seemed to vary among teachers; whereas some teachers utilized DWA results, others also valued their observations and used them when creating IEPs. Some teachers reported talking about data with other colleagues, parents, or with students for different purposes such as problem solving or progress reporting. Only a couple teachers mentioned using data for individualization or for adjusting instruction. There were different data analysis practices among participants. These practices are also related to teacher preferences. Every teacher chose a way to look at the data or not look at it at all based on their preferences. Teacher preference seemed to affect how they collect and organize data as well.

Theme 3: Teachers Received Different Levels of Professional Development.

All participants were asked if they received any professional development or training at any time of their career including pre-service or college education. These trainings could be for DWA, any measures they use, or other data related activities (e.g., administering assessments, or graph interpretation). All teachers reported receiving some kind of training at least once. The scope of the trainings received and whom they were received from was widely variable across teachers.

One of the most frequently seen patterns in interviews was that if a district provides an assessment system and pushes for its use, then they also provide training to teachers. For example, in T8's school they received the trainings for DWAs even though trainings happened at different times:

> This year, we had a full day training for the PRESS intervention earlier this fall, and then we had AimsWeb training. It was a while ago. I don't remember when we had it, but. That one. I think it was just like an hour, like this is how you do it. And then we talked about how to, like, adapt the assessment to meet our kids' needs.

T9 also received a training for their DWA and mentioned there is a self-learning opportunity as well:

> We do get a little bit of training and then you can take through FastBridge. We had to take you read all this stuff and then you do an assessment yourself on

> FastBridge to pass it, to then be able to give the different curriculum-based measurements to give the assessments.

These trainings were not always provided by an expert outside of the school. Some teachers learned how to use the assessments from other teachers. For example, T22 explained that she learned it from a colleague:

> That is a really good question. Not specific training. Like I didn't go to like a DIBELS training, but I worked with another person who was in the same position as myself and she taught me how to do the DIBELS. And then I did my own reading and research around it and how to use the data.

And then she also added that she taught other special education teachers.

T3 reported a combination of getting trainings from different sources. She learned how to analyze data from one of her colleagues early on her teaching career. She self-taught some assessments too. Then she decided to take a step and teach assessment classes to fellow special education teachers at a university. T3 explained her experience:

> Well, I actually taught the assessment class when I was at the U. So I'm very familiar with like Woodcock Johnson, all the standardized assessments. But since I've been in [a school district], I did not receive any formal training in like FastBridge, any of that. However, I would say there are opportunities to learn by. A FastBridge has lots of opportunities to learn online by attending online kind of webinars, those kinds of things. Knowing that I worked at the U. I worked very closely with [University faculty member] I knew all about CBM, so I'm very

> familiar with FastBridge. So I didn't attend any of those. But I would say that there were opportunities for to attend those if I needed them, if that makes sense. I didn't feel like I needed them, but I think there are opportunities for teachers if they didn't have that experience. I feel like I came with that experience, so I didn't need them.

Another difference in trainings received is the duration; for example, some teachers received only a day of training, like T7:

> And we had a training at the beginning of October a day, personal development training that someone came in and helped us with that.

Others received more training days and extra support like T4:

> It was a five-day week long training in the summer for Orton Gillingham and then SIPPS was implemented actually when I was on maternity leave. And so then I went and I watched a ton of YouTube videos, like there's little videos on like the SIPPS websites and mine or like in the curriculum when you can log in to it online. And then I also watched a couple other teachers teach at different buildings to see how they taught it, to make sure I was doing it correct.

Even though all teachers received some training, many teachers shared that they feel more training is needed for them and for other teachers in their building too. T6 and T3 commented that especially newer teachers coming with less experience in data use should receive more trainings. Additionally, T21 mentioned newer teachers may need more time to figure out to balance data use and other teacher tasks. On the other hand, T1

thought that the need is for all teachers because there is potential to grow and commented with:

> But the fact of the matter is it actually has a lot of capabilities that we're not always exposed to. And so I think unless we get better training, we're not going to be able to fully use the tools that we have in front of us to drive down into the specific areas.

Moreover, T6 brought another perspective to the need for more training with:

> Okay. Yeah, well, I think we have good systems like theoretically we're very set up to use that data effectively, if that makes sense. Um, I don't always think everyone prioritizes it or understands how to collect it and or how to analyze it. I think a lot of people collect it. I don't think a lot of people know how to analyze it. And I think even fewer people know how to use data to adapt instruction.

It can be implied that the need may be even more for data analysis, and for how to make data-based decisions and instructional changes.

As someone who taught assessment classes at the university level, T3 commented on the differences between trainings teachers receive with:

> Special ed teachers are trained very vastly different. And their training in terms of how to use data, what data is also very different based on where they get their training. And I just think that's really unfortunate because, I think the expectation from ... [licensing board of the state] …, their expectation is that all special ed teachers know how to use data when teaching in special ed, right. And so there is

> an expectation that all higher ed should be teaching special ed teachers how to use data to teach. Right. But again, I just think it vastly differs. …. And so it's just, it's unfortunate that we have such a discrepancy amongst the colleges.

Summary of the theme. Professional development for assessments or how to use data looks different for all teachers. Teachers seemed to have vastly different experiences with training opportunities. Yet, one common pattern found in the interviews was that school districts tend to provide corresponding training when they require teachers to use a certain assessment program. Teachers reported different forms and frequencies of training they received. Some teachers described learning from another colleague as a way of getting trained. Even though all teachers shared that they received some training, many teachers also added the need for more follow up or additional trainings.

Theme 4: Collaboration Is an Important Yet Missing Component. This theme emerged from the codes in which teachers expressed a form of collaboration with other colleagues or parents for data related activities such as interpreting assessment data or coming up with ideas to adjust instruction. There were also instances where teachers expressed the need for collaboration to facilitate data use.

The majority of teachers reported having a kind of collaboration with others. Some of these collaborations happened in a more structured setting where a team of colleagues came together regularly, while others happened less frequently and on demand. T4 and T22 mentioned having a special team to discuss assessment results and do problem solving. These teams had people with different specialties. T22 explained who is on the data team and their regular meetings:

> Yes, so we have a weekly team meeting and we bring concerns to the table and we talk about it as a team. So and everybody is present, our counselor, our speech language pathologist, our O.T. were all present because we're all have our expertise to offer. And so we do every week talk about data and where the holes are.

A unique collaboration example in this study's data is T20 since she has an assistant with her all the time. T20 described the collaboration with her assistant:

> The assistant I have right now she used to be a teacher and she didn't like it. And so she took the downgrade. And that's been absolutely amazing just having her to talk to. I just sometimes when I look at the data, I kind of get a thought and it's like "they're good. I think I'm making good decisions." But sometimes she can help me execute it quicker.

Other teachers had more on demand collaboration where teachers happen to face a problem with their students' progress and need help to brainstorm ideas. For example, when asked about what she would do when she sees her students not making progress, T9 replied with:

> Then I talk with my coworkers first, typically, and we have we're really lucky we have a person here. I don't know what her title is, but she's kind of like the head of curriculum at the school and she knows a lot about reading. So then I connect with sometimes I set up times to meet with her to to see what else I can implement, to help the student, to make more and more progress with the reading.

> And that so far has. Has worked. When I then when she helps me in implementing more stuff that has been working, which is great.

T7 asks for help from reading interventionists at her school when she needs it, and described the kind of help by saying:

> And they also help me determine looking at their AimsWeb scores, where they should be in the PRESS interventions too and what that you know because the two are at a different spot than the other three and you know, and helping me figure out where should I put this in my day and how can I add this in a nice way.

For teachers, not only their colleagues in their building but also other teachers they can reach out to online are there to collaborate. T1 commented on how she finds help and resources when she needs it:

> Additionally, sometimes I'm finding resources on like different, you know, shared sites or like teachers pay teachers. It's not like perfect or anything like that. But other teachers have created things and we're able to pull those together so that we're trying to solidify that language and move forward academically and social, emotional, socially and emotionally with children.

In addition to collaborating with other teachers, three teachers (T1, T6, and T20) also mentioned they collaborate with parents if they are available and on board. This kind of collaboration mostly occurred for practicing reading more at home and sending some more student practice work home.

Although the majority of teachers reported being involved in some level of collaboration, many of them still expressed the need for more collaboration at school. Most teachers made comments that having more support from educational assistants or paraprofessionals would be beneficial for them to engage in data use more. For example, T3 shared that she needs help especially for data collection:

> Um, yeah. I mean, we joke about it all the time. I wish. I wish I could have an assistant to help me collect some of that data. But, I mean, if we had that in time, I mean, if we had more time to be able to. If we had. If I had an assistant and if I had more time. But yeah, it can happen.

Or a support person can teach the class while the teacher collects data as T21 mentioned in her comment below:

> …to have my, my other instructional. A staff with me. And that way, if I'm assessing a student, they can still keep working on the group, or I can still keep working with the group. I can administer the assessment.

Although it looks like teachers needed more collaboration only for data collection, some teachers commented on the need for a more formal collaboration group. T20 commented on this issue with:

> I would love, and this is something that there is not an hour a day, I'd love to be able to meet with my teachers like monthly even just to go over all of it with them and see what their thoughts on it are and just that collaborative piece.

T6 also shared similar opinions about having a team of teachers to discuss data by saying:

> I think I wish there was more of a targeted team who was like having specific assessments they had teachers doing. But like. Giving them the support they need to do that data collection. Like, like, I think I've kind of said this like just a more structured schedule thing where data was being collected to analyze if you are problem solving.

Summary of the theme. Collaboration seems to be important for teachers and they reach out to other colleagues and even parents when they need help. However, the level of collaboration does not look enough for teachers and many teachers look for more structured or targeted groups of people to discuss data and do problem solving.

Theme 5: Resources Vary Across Schools and Content Areas. When teachers were explaining their experiences with student data, they often mentioned resources they have or they need for a rigorous data collection process. These resources were related to assessment, in general.

The availability of assessment seems to play a key role in teachers' data use. For instance, T3 started working in her district as a long-term substitute teacher at first. Because of her position, she did not have access to DWA and she used another assessment for progress monitoring which has free access. She explained her experience afterward with:

> So I was using easyCBM. And so it was interesting because a few special ed teachers got upset at me because I was progress monitoring, using the passages from easyCBM and not using FastBridge and. Part of me was kind of like, What's

> the difference? There's still passages, right? It's still a first grade passage. It's still a first grade passage. And so. Anyway. It was kind of like, you know, it's like it's comparing apples to apples for my perspective is still a first grade passage. Anyway, long story short, we kind of as a department decided that they wanted everyone to be progress monitoring and a FastBridge just because the kids are tested in FastBridge and in the fall and in the spring. And so that's what the district has decided, that they would prefer us to be progress monitoring and user groups.

Because of the school's approach to have unity in assessment practice, she then had access to those resources for assessment.

In T3's experience she did not have the resources at first due to her position, but there are other reasons which limit the ability to access the resources. One frequently mentioned reason is not having "good" (i.e., high quality, research based) assessments to measure some academic areas such as writing or math. After explaining his practice for reading, I asked if he has a similar approach to progress monitor for math and writing to T6. T6 replied with:

> I would say so for like math. We don't quite have the same level of assessments as we do for reading. So like, um, you know, everyone gets the screener for math, but we have no diagnostic assessment for more specific skills. So like in previous districts I've used, like, I don't know if you're familiar with like Advantage Math Recovery, but they have very specific diagnostic assessments that show you which skills are missing. That's more informative than the screener.

T6 added for writing by commenting with:

> And then for writing, really we don't have besides using the evaluation data. So like they get the big standardized like we use the KTEA, and some schools use the Woodcock Johnson. That's really the only formative assessment we really have for writing. So writing, I think is in conjunction with the occupational therapist, um, from the classroom teacher. It's a little bit more anecdotal to be honest, or what was in the evaluation. And then the occupational therapists have more specific info like about like letter formation stuff. But for writing, that's about it if that makes sense.

This problem was mentioned by T22, T7, T3, T4, T8, and T9 too. For some academic areas, there are limited opportunities to find a good assessment.

On the other hand, especially for reading, teachers were able to find a variety of resources and assessments. Some comments made by teachers are below:

> T3: So we have different programs that we can use within our building. To use as interventions. So there's different reading programs that we can use. And then there aren't a lot of math programs that we can use. So it's a lot of just kind of mixing, if you will, and creating kind of your own program, if you will, and trying to see what works with the students.

> T4: I use FastBridge for my reading fluency, and then I ask comprehension questions like who, what, where, when, after we've like, read a passage. So, like, they'll read for a minute, then we'll read the whole passage together and then I'll

> ask them questions to see if they comprehended what they read. The Orton Gillingham. I was trained through a different district. Paid for that training. But we do have SIPPS curriculum as well that we can use for reading.

When talking about availability of assessments, some teachers mentioned using "built in" assessments in the curriculums they use. T1 commented that:

> …the other curriculums that I use do have built in assessments. So they will tell me if the student is progressing throughout that assessment and if they're not or throughout that curriculum, excuse me. And if they're not, then we do some of that reteaching like I was talking about before. We're like two kids maybe are being challenged over here while I'm trying to get this one back at their level.

T4 also shared that she gets data naturally every time she teaches the curriculum, and said:

> So I use like the Sonday Word book. And so that's how I know, like what sounds to teach next and how to teach them, because it all goes in order in this book. And then so that's just like natural data that I get every single time I teach Orton, which is twice a week.

From their comments, it seems like built in assessment may come handy to get along with the flow of the instruction. Hence, it may be preferred over administering external assessments.

Summary of theme. Teachers' ability to access resources they need differs from one district to another, and also for one content area to another. Some districts are better

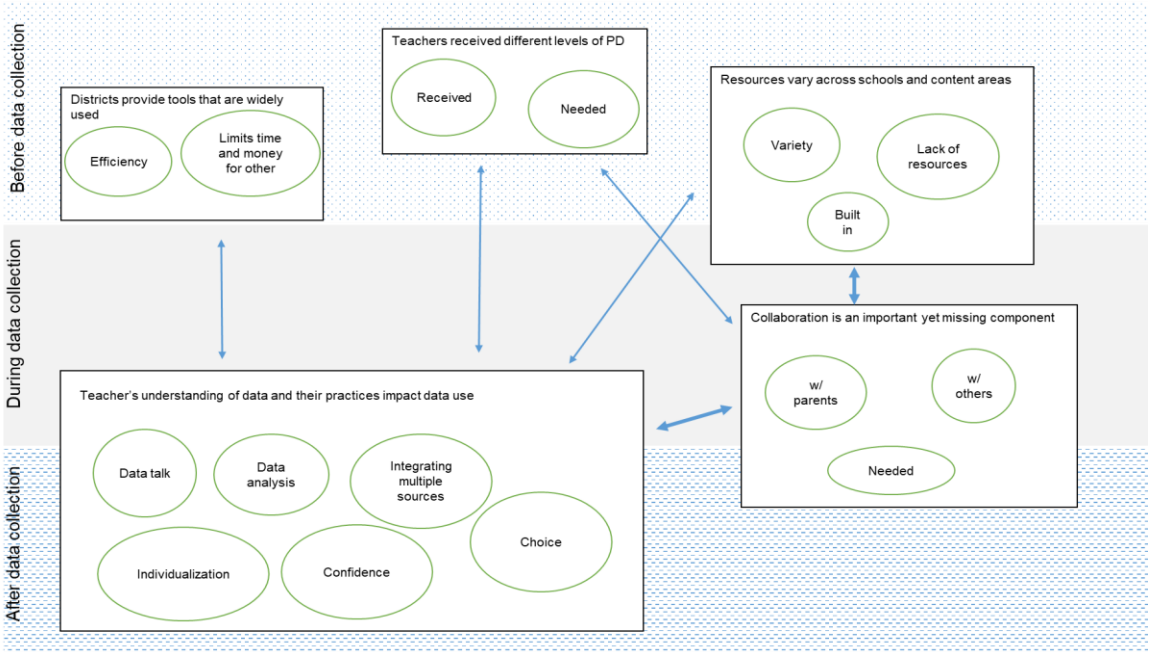
at purchasing and providing more resources which gives teachers the flexibility to choose the better assessments for their students. Also for some academic areas, there are more options to collect and analyze student data, where for other academic areas options are limited.

Explanation of Theory

This investigation led to a theory derived from the qualitative data collected for this study. This theory explains how teachers engage in data use and what contextual factors affect their data use. The theory is shown in Figure 3. Below, I give a brief explanation of the figure, then I explain the relationship between themes and how the theory works in detail.

Figure 3

Theory of Teachers' Data Use Engagement



The five rectangular boxes in Figure 3 represent five themes that constitute the Theory of Teachers' Data Use. The oval shapes represent the intermediate codes within each theme. The background has three different layouts. The top dotted area includes themes and intermediate codes mostly related to teachers' experiences *before* data collection. The middle solid gray area represents the themes related to the activities done *during* the data collection. The bottom dashed area includes the themes that includes activities mostly relevant with teachers' experiences *after* data collection. Bold lines represent the relationships between themes that are found by using the matrix query analysis in Nvivo program. Matrix Query analysis allows the researcher to see a wide range of patterns in the data. The relationships shown with bold lines represent a pattern in the data which shows an overlap between themes. The other lines represent the relationship between themes I added based on inferences I made from the interviews.

Teacher engagement in data use is dependent on a lot of contextual factors. Availability of assessments that are designed to measure targeted skills; receiving training on how to use assessments; or having a district wide assessment system that scores, stores, and analyzes data can be thought of as important facilitators for teachers' data use. Yet, none of these contextual factors were the main facilitators of the process. Based on the data, the comments made by teachers during the interviews, the most referenced codes are related to *Teacher Preference* under Theme 2. This finding aligns with Cho and Wayman (2014) study where researchers found that teachers' priorities were the main determinants of how and why they use data systems. They found that data

systems can be a facilitating agent to data use if educators sensemaking of data allows them to effectively use these systems.

The second most frequently referenced code is *Collaboration with Others*. When explaining their whole data use experience, teachers described the procedures mostly with teacher level factors and collaboration related experiences.

This theory divides the themes into different stages of data use. I decided to use a three-stage procedure to describe teachers' data use experiences: before data collection, during data collection, and after data collection. To be able to effectively use student data for instructional purposes, meaning that to individualize instruction based on student needs, first there has to be "data." Regardless of the data type, without data collection, data-based decision making would not be possible. With this theory, the more effective themes can be identified for each phase of data use. The tools provided by the district or school, the training that teachers received, and other resources can be present before the data collection and may have an impact on teachers' data collection practices even before it starts. Teachers' understanding of data (i.e., their value for data talk, understanding of data analysis, efforts to integrate multiple data sources, concept of individualization, confidence in data, and preferences on data collection) and collaborative practices can be effective during and after data collection.

The data suggested that there are two relationships between themes: the relationship between Collaboration theme and Resources theme, and the relationship between Collaboration theme and Teacher theme. In addition to the relationship suggested by Nvivo qualitative data coding, I suggested other possible relationships

between themes. First, I describe the relationships suggested by the data, and then I explain my interpretations for possible relationships between themes.

Relationship between Theme 4 and Theme 5

The relationship between "Theme 4: Collaboration is an important yet missing component" and "Theme 5: Resources vary across schools and content areas" stems from a problem that teachers often face. As mentioned previously, some schools have more resources than others, or for some academic areas (such as reading), a variety of resources are available for teachers. On the other hand, teachers struggle to find a "good" assessment for measuring some targeted areas. Based on the data of this study, teachers can find resources through collaborating with their colleagues in case they do not have access to what they need. T9 shared that she could collaborate with a lot of colleagues for reading, and when I asked about her experience for writing, she replied with:

> It's just different now with the writing, just based on. I then go to the occupational therapist that works with my students and I talk with her sometimes because lots of it is about that letter formation. So then I connect with her to make changes. And she helps then too.

As she commented earlier in the interview, she did not have access to writing resources. Teachers may try to remediate the lack of resources by collaborating with other teachers and trying to find ideas or exchanging tools.

Relationship between Theme 2 and Theme 4

Based on the data, the relationship between "Theme 2: Teacher's understanding of data and their practices impact data use" and "Theme 4: Collaboration is an important yet missing component" arises from collective efforts of teachers for individualization of instruction and team of teachers working together through problem solving. At many times, teachers made references to collaboration opportunities they had with other colleagues at their building, yet they still reported looking for more collaborative practices. When I asked whether they feel confident about the amount of data they have, T22 responded with:

> Yes, so we have a weekly team meeting and we bring concerns to the table and we talk about it as a team. So and everybody is present, our counselor, our speech language pathologist, our O.T. were all present because we're all have our expertise to offer. And so we do every week talk about data and where the holes are.

This comment shows that T22's confidence in data is coming from the collaborative effort behind the data analysis. Later in the interview, T22 also expressed the same team of colleagues also does problem solving and creates individualized plans for students who are not making progress.

Other Relationships Between Themes

As I mentioned before, the relationships shown with narrow arrows in Figure XX are constructed based on my interpretations from the interviews. When explaining their

experiences, teachers did not always explicitly use phrases that directly referred to themes. Rather they mentioned each theme at different time points during the interview, so that I could make inferences about the relationship between them, but the coding program would not show it.

The preference category under *Teacher's understanding of data* theme is a very comprehensive coding category. Even though I mainly captured teachers' choices on data collection or the data type under this category, a lot of other data related tasks can depend on teachers' preferences. For example, although their districts provided an assessment system at the school level to all teachers, some teachers preferred to use other assessments for progress monitoring. Teachers do not always use easily accessible measures like CBM because they do not have other options. Sometimes they specifically prefer to use them.

Similarly, when provided with a variety of resources, some teachers reported using a combination of these assessments, meaning integrating multiple sources of data, when making decisions. Teachers' preferences and confidence in assessment types may affect this selection.

Even though teachers did not specifically attribute any of their data related activities to the training they received, teachers may tend to choose to use the practices that they were taught. For example, one teacher participant of this study continued to use a reading program she was trained through a different district even though the current district provided other programs. This may not be the only reason behind selection of that

reading program; however, the effect of receiving PD can be an underlying reason for preferences.

The last relationship not captured by the data coding is between "Teachers received different levels of PD" and "Collaboration is important yet missing component". When teachers did not receive a training for some reason, some of them collaborated with other teachers to learn and practice skills.

Summary of The Theory

The theory of teachers' data use consists of five main themes and the relationship between and within these themes demonstrates how teachers who participated in this study experience data use. These themes are: (1) Schools and districts provide tools that are widely used, (2) teachers' understanding of data and their practices impact the data use, (3) teachers received different levels of professional development, (4) collaboration is an important yet missing component, and (5) resources vary across schools and content areas. Interview data suggests that the relationships between Theme 2 and Theme 4, and Theme 4 and Theme 5 are stronger than the relationships between other themes. That indicates that teachers commented about these themes together when they explain their data use practices during the interview.

Teachers mostly commented about Themes 1, 3, and 5 when they responded to the questions were asked to understand what happens before data collection. District provided tools are widely used by teachers, yet they come with limitations in which not all teachers can effectively use them for data collection and analysis. Teachers also

shared different experiences about receiving a PD on how to use these tools, or PD on data use in general. Regardless of how much PD they received, many teachers pointed out the need for more training and support. Even before data collection, the resources vary vastly across schools and for different academic areas. Teachers' understanding of data and their practices were found to be relevant during and after data collection mostly. Their preferences over data collection frequency, method or data analysis seemed to determine their data use practice. At teacher level, having data talks, doing data analysis, integrating multiple data sources for decisions, individualizing instruction and data collection, and their confidence were the other factors that shaped teachers' data use experience.

Teachers tend to collaborate with other teachers to have data talk, for doing data analysis, or to brainstorm for ideas for individualization. They value the importance of collaborating with teachers, parents and others yet they also bring a lot of barriers due to lack of opportunities to collaborate. Teachers also engaged in collaboration to remediate having lack of resources for data collection and other data related activities.

As a summary, this theory claims that teachers engage in data use in an environment where district level practices, availability of PD and support, availability of resources, opportunities for collaboration, and their understanding of data affects their data use experiences. The relationship between themes are not always linear; meaning there may not be a two-way relationship between any two themes and there may not have equal effect on overall data use.

Chapter 5

Discussion

In this study, I employed a grounded theory design to investigate the following research questions: (1) What are the dispositions (attitudes and perceptions) of teachers toward collecting progress monitoring data and using the data for creating individualized instruction for students who are not responding to the current practices?, and (2) What types of data do teachers collect and use for individualizing instruction, and how do teachers use the data to inform instruction?

In this chapter, I review teachers' dispositions toward data use, their data use experiences and their data related practices; and identify potential facilitators and barriers to teachers' engagement in data use. I relate the findings from this study to existing literature on special education teachers' data-based decision making while reviewing the results of this study. Then, I share the limitations of this study, recommendations for future research, and implications for educational practice. Throughout the discussion section, when I mention "teachers," I am referring to the teachers who participated to this study. Since this study is a qualitative study, the results from the study cannot be generalized to all teachers.

Teachers' Dispositions toward Data Use

Although actual implementation of data-based decision making by teachers is not always clear, previous research suggested that teachers generally have positive attitudes toward their ability to use data and toward data use (Brawley & Stormont, 2014; Demchack & Sutter, 2019; Du et al., 2013). Aligning with the literature, the findings

from this study support the high self-efficacy, positive attitudes, and intentions toward data use (see Table 3). In addition to data use survey results, findings from the interviews also show that teachers feel confident about the data they have. One explanation for the positive attitudes can be that teachers participated in this study on a voluntary basis, and they were informed of the focus of the study before their participation. Hence, it is very likely that teachers who were interested in participating in this study were interested in data use.

Moreover, findings from this study demonstrate that when teachers do not believe that the assessments reflect their students' performance, they prefer not to use the assessment for progress monitoring. This finding also complements previous studies such as Rowe et al. (2014) which found that teachers do not consider a measurement tool as a useful data source when they have concerns about the assessment.

Possible Facilitators and Barriers

In addition to generating a theory, the data from this study also suggests possible facilitators and barriers to teachers' engagement in data use.

Possible Facilitators

I identified possible facilitators of teachers' engagement in data use by examining participant comments about how they conceptualize the contextual factors for data use. Teachers' understanding of data use (e.g., teacher preference), collaboration, and district level practices seemed to affect data use experience more than other themes.

Participants of this study shared positive experiences about their District Wide Assessments (DWAs). *Districts and schools' encouragement* to use the same assessment system within a building may bring many facilitators. Teachers found the DWA systems easy to use and to share data with other colleagues. This feature makes data collection easier and also enhances having a data talk with others. In most cases, districts also provide trainings for the DWA systems they use. Teachers found these trainings helpful in most cases.

Another facilitator associated with DWAs is that when teachers need to report progress monitoring data, they tend to have more frequent and regular data collection practices. Based on interviews with teachers, it seems like the accountability feature of DWAs encourages teachers to collect and analyze student data. This finding aligns with previous literature such as Farley-Ripple et al.'s (2021) study where teachers were found to collect data more around the times for progress reporting during the year. In another study (Poch et al., 2020), teachers shared that meeting with a coach held them accountable for collecting data. Hence, having someone to report to or a top-down requirement for data use seems to facilitate teachers' engagement in data related activities.

Patterns across interviews suggested that teachers utilize any *collaboration* opportunity to ask questions, gain ideas, or do problem solving. However, almost all teachers also shared the need for more collaboration with and support from colleagues. The more focused and structured collaboration practices may be an important variable to

investigate more in the future since the interviews conducted for this study revealed that teachers who use data regularly also have opportunity to collaborate for data use.

Data suggested that teachers' practices were mostly affected by their *choices*. Teachers seemed to decide for themselves what kinds of data they collect and how they analyze the data. For example, teachers determined the format of assessment as paper-pencil even though DWA can be applied online, or teachers determined what constitutes enough progress for some academic areas. Teachers also reported making choices about which kinds of adaptations they use for individualization of instruction. Although literature suggests that teachers tend to collect data more around the times for progress reporting during the year (Farley-Ripple et al., 2021), and top-down requirements are helpful to initiate data use, the data from this study suggests that teachers' preferences play a key role in which assessments they use and at what frequency they collect data. Applications like submitting a form that reports the data use practices of teachers each month may facilitate teachers' more frequent data collection, yet in most cases it is still up to the teachers how much data collection happens.

Last, data showed that teachers integrate multiple sources of data when making decisions, hence accessing resources is important for teachers. Having resources to collect progress monitoring data from students and to manage data may enhance teachers' ability to collect more data and to engage in data use for instructional purposes.

Possible Barriers

I identified possible barriers to teachers' engagement in data use by examining participant comments about how they conceptualize the contextual factors for data use.

District level contexts and practices (e.g., lack of resources, or mandatory practices), collaboration related factors (e.g., lack of collaboration), limited time, and lack of training seemed to affect data use experience more than other themes. Teachers more easily found solutions to the barriers that were aroused by other themes. The possible barriers I identified were from themes similar to possible facilitators. The reason might be that a theme could be easily a barrier or a facilitator for teachers' data use based on availability, accessibility, or flexibility of the interaction of teachers with these themes.

The first identified possible barrier is *schools' approach to DWAs*. A school's approach to use the same assessment for all students was found to create some limitations for teachers. Some teachers shared that the DWA was not appropriate to assess the targeted skills at their students' level. They spent time to administer DWA at least once, but they did not utilize the tool after that. When schools invest in a system, there may be limited resources left for additional assessment or intervention purchases. Such contextual factors may limit teachers' ability to engage in data collection and data use.

Second, *collaboration related factors* that may be a limitation for teachers were related to the lack of collaboration opportunities. Teachers commented on not having enough support for data collection or data analysis. For example, some teachers shared that they need an assistant to collect data because most data collection happens one-on-one, hence they need another person to teach other students during data collection. Or other teachers commented that they wished to have regular data team meetings or to discuss student data. Not having a support system and lack of collaboration may be a limitation for teachers' data use engagement.

Third, another pattern found in the data is *limited time*. Teachers' common ground is having limited time. Findings from the study suggest that teachers have limited or no time for collaboration, data collection, and data analysis. As a result, teachers may not discuss data and problem solve with other colleagues, and they may collect progress monitoring data less than usual. Similar experiences shared by teachers in Poch et al.'s (2020) study where teachers commented about having limited time for data related activities or having meetings to discuss data.

Last, one pattern in the data revealed that the majority of teachers received one-time training for using the assessments they were prescribed to use. Some teachers found the trainings to be not enough, especially for data analysis and how to use data for decision making. *The lack of training* may lead teachers to collect data, score and store the data, yet not use the data for instructional decision making. Previous studies showed that the amount of data use training teachers received at pre-service and in-service varies across the country (see Greenberg & Walsh, 2012); especially for data interpretation and linking data to instruction (e.g., see Jimerson & Wayman, 2015; Mandinach et al., 2015). The findings from this study show that teachers received some trainings, at least once, to learn how to use assessments, how to score assessment and maybe how to interpret assessment results. However, the trainings seemed to look different for every teacher; the answers for how frequently they got training, whether they received training for all assessments, or whether they learned how to analyze data were not the same for all teachers. Given that the sample of teacher in this study is highly interested in data use, it is not surprising that teachers reported using data for many purposes; yet still the data

analysis practices varied and the reasoning behind which methods they use for data analysis was not clear for many teachers.

Data Types and Frequency of Data Collection

Results of this study demonstrated that teachers were active decision makers on which assessments they use for progress monitoring. In most cases, teachers found the assessments prescribed by the school helpful and efficient, but when they thought the assessment did not work for the students, they opted to use other options. Teachers' knowledge of availability of other options and their ability to access these options may play a key role to make these decisions as well.

Previous literature also provides some information about the types of data that are collected at schools. However, there was very little information about what teachers use as sources of data when they monitor progress and individualize instruction. In one dissertation study, Pham (2011) found that teachers reported relying on standardized assessment results for decision making. The data from this study shows that special education teachers who participated in this study use multiple sources of data when making decisions such as determining IEP goals or making instructional adaptations (see Table 4 for types of data sources). All participants reported using some form of informal data in addition to data from DWA while some teachers provided detailed explanations of how they integrate informal data into their decision making. The findings from the study add informal data to data sources listed in the Pham (2011) study. Some participants of this study used informal data for determining students' progress and the changes should be made in instruction while others utilized it to determine strengths of the students. Even

teachers who did not use informal data regularly for progress monitoring reported utilizing informal data on a daily basis to plan their next instruction.

When systematic approaches to individualizing instruction like DBDM were introduced and encouraged, researchers claimed that teachers rely mostly on informal observations for decision making (Deno, 1985) and systematic approaches would be more beneficial for teachers (Deno, 1992). Given that the sample for this study reported having some experience with data use, and even some of them reported receiving higher education such as having M.A. or Ph.D. degree in special education, it was surprising to see that all teachers used informal data this much. One explanation of this result may be that their teacher education program might have emphasized informal data use more as discussed in Ledesma's (2013) study. Another explanation might be the accessibility of formal data sources, yet the participants of this study reported easy access to formal data sources. Hence, the use of informal data is likely to be a result of teachers' choice to use it.

Data Analysis

Previous literature on the data analysis part of the data use process mostly focused on the graph literacy of teachers (e.g. Espin et al., 2017; van den Bosch et al., 2017; Wallace, 2019). Graphs provide a visual representation of students' performance in relation to an expected growth projectile. To be able to determine students' performance, teachers need to read the graph and make inferences about the performance. For example, a comparison of students' present level of performance should be compared to a projected growth line that leads to a goal. Teachers were found to identify the features of graph and students' performance within a progress monitoring graph but they did not

make a lot of connections from the data to the instructional practices (Van den Bosch et al., 2017). Data from this study shows that majority of teachers preferred to look at the progress monitoring graphs provided by the DWA they used. They commented that the automatic data graphing features of DWA makes it easy to check students' performance. Even teachers who did prefer using paper pencil assessments reported drawing graphs or creating tables manually to keep track of data. Data from this study suggests that teachers who commented on using graphs positively shared more details on their analysis process. They explained their thought and decision making processes in more detail than other teachers. This finding adds a different perspective to Espin et al. (2017) study where researchers compared the specificity, coherency, and accuracy of graph interpretation made by special education teachers to the graph reading experts. In Espin et al.'s (2017) study, researchers presented progress monitoring graphs to teachers and asked them to think aloud while commenting on the graphs, and the experts rated teachers as low or high based on how specifically, coherently, or accurately teachers interpreted graphs. In the current study, I did not provide any graphs to teachers and ask them to comment on them, yet the findings from this study shows that teachers who had positive comments on graphs also provided more detailed explanation of their analysis processes. Other data analysis methods identified in this study include setting rules for accuracy percentage or identifying errors to determine areas of need.

Since a detailed exploration of teachers' graph literacy or accuracy of decision making rules was not employed in this study, I cannot draw inferences on how accurately teachers engaged in data analysis. Yet the similarities and differences in their comments on how they analyze data provide some insights. First, van den Bosch et al. (2017)

analyzed teachers' graph reading skills to see how well teachers can read, interpret, and link the data to the instruction. Similar to their findings that most teachers were able to identify and read the graphs, teachers in this study are also familiar with the features of graphs such as trend line or goal line and can identify them. The easy access to the graphs through DWA makes teachers' jobs easier. When they explained how they make changes in instruction, they shared that the graphs give them indication for a change, but they mostly use informal data to decide what changes should be made. Second, teachers reported not using graphs shared either having a strict rule for progress (e.g., 95% accuracy) or not sharing a lot of details about their decision making process. Hence, checking progress monitoring graphs seems to provide clearer procedural guidance to teachers. And if teachers do not prefer graphing data, they may have other rules to determine progress.

The differences may be a result of receiving different levels of training related to data related products and data use. As demonstrated in Greenberg (2011)'s report, not all trainings and PD provided to teachers were focused on data analysis and making data-based decisions. Another reason for not using graphs can be related to having limited time. Some teachers who did not have automatic data graphing support from a DWA shared that they were not able to manually graph data because they did not have enough time to organize data that way. Hence, they found other methods to check their students' progress, but it is still unclear how systematically they organized and stored the data.

Theory of Teachers' Data Use Engagement

The Theory of Teachers' Data Use Engagement (see Figure 3 in Chapter 4) explains the interactions teachers who participated in this study have during data use and how they experience the notion of data use. Five main themes generated the theory: (1) districts provide tools that are widely used, (2) teachers' understanding of data and their practices impact data use, (3) teachers receive different levels of PD, (4) collaboration is an important yet missing component, and (5) resources vary across schools and content areas. Districts provide tools such as DWA so that teachers use these systems for all students, and they have unity in assessment practice. Although DWAs are efficient to use, they bring some limitations as well. Based on the results of this study, teachers' understanding of data has an impact on the kinds of data they collect, the way they collect and analyze data, how they use data for individualization, and how confident they are with the data. Teacher choices over procedural things are mainly led by their understanding. Teachers also received some sort of training at some point of their career, yet these training experiences vary hugely and there is always a need for more training on data use. Collaboration is very important for teachers' data use practices, and they tend to collaborate with other colleagues. However, teachers are still looking for more opportunities to collaborate or more structured collaboration for data related activities. Last, teachers have access to resources to teach and administer assessment the targeted skills for each academic area, but the amount of resources (especially "quality" resources) vary across buildings and academic areas.

The theory shows where teachers interact with each theme. Teachers may interact with the tools provided by their district at all three phases to check student profiles, to collect data, and to use data analysis features of these tools. Teachers' understanding of data and their practices may be seen as influencing data use during data collection and after data collection. Teacher choices, their individualization and data analysis practices, and confidence have an impact on how they collect data and how they analyze it. Also talking about data and integrating data sources for decision making usually occurs after data collection. The amount of PD received by teachers interact with before data collection phase, in general. Before data collection teachers bring their knowledge and skills set gained through PD to their practice. Collaboration among teachers and with parents are in interaction with during data collection and after data collection. Teachers also need more collaboration support at these phases. Finally, availability of resources affects teachers' experience during data collection and after data collection phases.

Theory of Teachers Data Use Engagement vs. Data-Based/Driven Decision Making Frameworks

The framework of DDDM or other suggested ideal DBDM (see Mandinach, 2012 or NCII's 2013 DBDM suggestion) implementations consist of step-by-step approaches to using research based interventions, data collection, and data analysis. With these guidelines, teachers were encouraged to engage in data use and make instructional decisions by following these steps. Mandinach (2012) argued that human capacity and technology tools are the two key components to create a culture for DBDM in educational settings. According to Mandinach (2012) technological advances can be

useful for teachers since they have more data every year than ever, and "pedagogical data literacy" should be obtained by teachers to data into actionable items in instruction. .

The theory based on the data from this study does not necessarily contradict the suggested DBDM frameworks. Rather, it shows in rich detail how teachers interact with data, resources, technological tools, and other people during data use. Data collected from interviews in this study shows that teachers' data use is not always linear and depends on more elements than technological tools and human capacity. Teachers may face disruptions during any step of a data use cycle which creates a non-cyclical process. The reason for a non-cyclical process of data use varies across teachers; some teachers do not have all the resources (not limited to technological tools), some teachers do not have time to sit and organize data, some teachers need more collaborative support, or some teachers do not prefer systematic approaches and like to rely on informal data on a daily basis.

The theory emerged from the data of this study reveals that audacity (i.e., teachers' choice/preference), district wide implementation, resources available, collaboration, and PD are the key components of engaging in data use. Even though this study did not assess teachers' data literacy, the interviews had a lot of information about the trainings and PD opportunities that teachers received. Similar to Mandinach (2012)'s two key components, this theory of teachers' data use shows a relation between data engagement and technological tools and PD on data use. Yet, I suggest three more foundational components toward data use; collaboration, audacity, and resources. Future research efforts should investigate the effect of environmental and organization support, and the effect of teacher values on DBDM implementation by remediating the needs and testing the changes in teacher behaviors before and after.

Limitations of the Study

Voluntary participation to the study resulted in a sample that appeared to be highly motivated to use data. Participants of this study were special education teachers who valued data use for providing better services to their students. This study provides a somewhat limited perspective on barriers and facilitators toward data use as there was not a teacher who does not engage in data use or was unmotivated to use data in this study. Hence, the proposed theory of teachers' data use cannot be generalized to teachers with low motivation to engage in data use or with no experience with data use.

Since I conducted this study remotely, the theory is constructed only based on interviews. Further exploration by observations and conducting additional tests to determine teachers' knowledge and skills may provide more information about their data use experiences. Working with school districts may also provide an opportunity to observe collaboration dynamics at a school or to uncover the data use culture in which teachers practice.

Identifying potential barriers and facilitators in this study relied on inferences made by using patterns found in the data. Hence, the discussion about potential barriers and facilitators is limited to the patterns among 10 interviews conducted in this study. These factors require further exploration and testing.

Finally, although I used several validation stages to rule out any biases, my perspective is a part of designing this study and constructing the Theory of Teachers' Data Use Engagement. My comprehension of data based decision making takes the data

collection as the center of the framework. Hence, when designing interviews questions or constructing the theory, I used an intellectual flowchart of pre, during, and after data collection procedures.

Recommendations for Future Research

I recommend future researchers to test the theory of teachers' data use engagement itself. Specifically, they could investigate the relationship between teachers' understanding of data use and other themes like collaboration and PD. Teachers' understanding of data use may determine their choices of practice during data use, and PD may have an effect on shaping teachers' understanding. Additionally, the effect of collaboration in data use practices should be investigated more. Teachers tried to find ways to collaborate with others to remediate the barriers they encounter; hence it is important to figure out the relationship and to find ways to facilitate collaboration. Future research could focus on the effects of a collaboration program implemented in a school on teachers' dispositions, their data use experience, and student achievement. Designing a collaboration program (e.g. Professional Learning Communities, see Burns et al., 2018) in which teachers receive PD, construct a team, and have regular meetings to discuss student data may improve teachers' overall data use experiences, and, as a result, student achievement.

Another recommendation for future research is to explore the effect of top-down requirements from schools to teachers on teachers' data use practices. This study shows that it encourages teachers to collect data regularly. However, it should be explored more whether it actually motivates teachers or burdens them with extra work and creates

negative attitudes. Teacher choices were found to be one of the important decision makers in how to use data or what data to use. And, some teachers reported district wide implementations can bring additional yet not necessary (for their students) practices. Future researchers could explore whether there is an optimal combination of top-down or bottom up encouragement of data use.

Last but most importantly, future research should focus on finding ways to integrate informal data to systematic data-based decision making process. Based on interviews and teacher-shared experiences, informal data (mostly from observations) are part of teachers' decisions, and teachers seemed to not ignore the informal data. Teachers who participated in this study value informal data and they choose to use informal data for their instructional decisions regardless of their background and education level. If teachers become more conscious about their decision making and they improve their understanding of data use, the use of informal data could be utilized better and in a more reliable and systematic way for data-based decision making for instructional purposes. Previous literature focuses on decision making with formal data such as data retrieved from progress monitoring measures. For example, Lembke et al. (2018) and McMaster et al. (2020) delivered a PD program to teachers to improve special education teachers' knowledge and skills in using DBI for writing and to improve students' writing outcomes. Teachers learned how to collect data with CBMs. The researchers provided trainings, tools, and coaching support to teachers so that teachers can engage in data collection, data analysis and decision making processes, and ultimately become independent decision makers by using data. Similar to Lembke et al., (2018) or McMaster

et al. (in preparation), a training program in which teachers learn about how to become like scientific thinkers to be able to analyze the students' needs, data and to make more data based decisions could be provided to teachers so that teachers can utilize informal data in a systematic way. As a result of this training program, the changes in their data use behavior could be observed and tested.

Implications for Practice

This study provided an explanation of how teachers engage in data use and what contextual factors may affect their experience. Interviews conducted with 10 teachers reveals some information about how they can be supported in educational settings. There are two main things that teachers can be supported for a better data use experience: training and collaboration.

The first implication for practice is providing trainings that are more focused on data analysis and linking data to instructional changes. Teachers reported the need for more frequent and regular PD especially on how to use data for instructional purposes. All teachers shared that they received at least one training at some point in their career. Yet not all teachers are on the same page to collect, manage, analyze and use the data. DWAs provide an easy way to collect and manage the data; it even provides automatic data analysis. However, not all teachers favored using DWA; and even if they reported that they like it, they still needed help to make instructional decision making. Additionally, trainings in which teachers can learn about systematic data based decision making may help to create a mindset and a culture that yields teachers to make scientific

and effective choices. Such a training can also include integration of informal data use into a systematic decision making.

Previous research demonstrated that teachers' knowledge and skills in DBDM and their understanding of data may result in better use of data-based decision making (Cunningham et al., 2004; Spear-Swerling & Zibulsky, 2014; Espin et al., 2017). An implication could be that improving teacher understanding with PD may result in better choices and better data use.

Teachers who missed a training session or did not receive PD on a DWA reached out to other colleagues and collaborated with them. But collaboration was not always available for all teachers. During the interviews, teachers shared how collaboration helped them and they also stressed the need for more collaboration. Educational practitioners should consider creating an environment and culture which provides more opportunities for teachers to collaborate on data use and decision making.

Conclusion

The current study found that teachers shared positive beliefs and attitudes toward data use. Teachers mostly felt confident about the data they have, and their confidence about the data itself or the tools they use seemed to affect their data use choices. Teachers' understanding of data use, collaboration among teachers, and district level practices were shown to have greater effect on teacher' data use practices. When provided with enough support, tools, and collaboration, teachers can engage in data use efficiently. When there is less collaboration for data use, or lack of training and support

for teachers, teachers may find it difficult to engage in data use regularly. This study also demonstrates what data sources teachers rely on, how they collect data, and what changes they make in instruction.

Five themes emerged from the data of this study and constructed the theory of teachers' data use. These themes are: (1) districts provide tools that are widely used, (2) teachers' understanding of data and their practices impact data use, (3) teachers receive different levels of PD, (4) collaboration is an important yet missing component, and (5) resources vary across schools and content areas. This study extends existing literature by bringing teachers' perspectives on data related activities to the foreground. Data from this study shows that teachers has a lot of disruptions while they use data for instructional purposes and the interactions that teachers have during data use are between five main concepts (e.g. five themes of the theory). Additional research is needed to investigate the ways to integrate informal data to systematic data-based decision making, the effects of top-down practices on teachers' data use, and the effect of teachers' understanding of data use on their preferences.

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Appendix A

Data Use Survey

Data characteristics (scale 1-4 ranging from strongly agree to strongly disagree): α =.85
I have access to student data in an information system
I can find all the data on my students in one system
I have access to relevant data on my students
Data on my current students are available at the beginning of each school year (within 3 weeks)
When students starts in the middle of the school year, their data becomes quickly available
The data I have access to help me plan my lessons
With the data I have on my students I can determine the growth of my students from year to year
I have data on the progress of my students
I have too little data on my students
The data I have on my students are up-to-date
The data I have on my students are accurate

User characteristics (scale 1-4 ranging from strongly agree to strongly disagree): α =.80
I am able to adjust my instruction based on data
I am able to use data to diagnose student learning needs
I understand the quality criteria and concepts for data use (for example, correlation, validity, reliability)
I know how to interpret data and reports I receive (exam results, student achievement results of previous years)
I am comfortable in interpreting data that are presented in graphs
It is important to use data in determining individual student needs
Data are important in changing my teaching
Students benefit when instruction is based on data

School organizational characteristics (scale 1-4 ranging from strongly agree to strongly disagree): α =.92
Our principal encourages data use as a tool to support effective teaching
My school leader/head of department encourages data use as a tool to support effective teaching
My school leader/head of department is a good example of an effective data user
My school leader/head of department creates many opportunities (e.g. time) for the faculty to use data

Our school leaders discus the results of their data analyses in the school
My school leader discusses data with me
My school is aware that we need to keep developing the skills of teachers to analyze data
Teachers in my school share a common understanding about what good teaching is
Teachers in my school share a common understanding of what student learning is
Teachers in my school share a common understanding about effective ways to evaluate student learning
Data use is a priority in my school
In my school we use a structured method to analyze and interpret data to base actions on
I am adequately supported in the effective use of data
There is someone who answers my questions about using data
There is someone who helps me change my practice (e.g. teaching) based on data
There is specific time set aside for me to use data

Collaboration (scale 1-4 ranging from strongly agree to strongly disagree): α=.0.74
I share and discuss the results of my students with students
I share and discuss the results of my students with parents
I share and discuss the results of my students with other teachers

Data use for accountability (scale 1-4 ranging from strongly agree to strongly disagree): α =.0.75
The data we use for accountability purposes (e.g. towards parents, the inspection) represent the reality
Internal evaluations are (also) used for other purposes then external accountability (e.g. the inspection)
Results of our internal evaluations are documented in external reports (e.g. a report for the inspection)

Data use for school development (scale 1-4 ranging from strongly agree to strongly disagree): α =.0.87
In our school we use external evaluations (e.g. from the inspection) for our own improvement
Results of students are used to evaluate teachers

Data use for instruction (scale 1-6 ranging from never to a couple of times per week): α =.0.91
To what extent do you use data to:
set learning goals/targets for individual students

determine which topics and skills students do and do not possess
determine progress of students
tailor instruction to individual students' needs
set the pace of my lessons
Give student feedback on their learning process
form small groups of students for targeted instruction
identify instructional content to use in class
Study why students make certain mistakes
Adapt instruction based on the needs of gifted students
Adapt instruction based on the needs of struggling students

Attitudes Survey

Collective Efficacy (five point scale: completely disagree, disagree, neutral, agree, completely agree) α=0.79
Our team can motivate each other to use data
Our team is confident that every ember is able to learn how to use data
Our team is motivated to learn how to use data
Our team is able to share knowledge with each other
Self-Efficacy (five point scale: completely disagree, disagree, neutral, agree, completely agree) α=0.78
I am able to define problems based on data
I am able to analyze data
I am able to formulate possible explanations for a problem
I am able to formulate improvement actions based on data
I am sufficiently skilled to use data
I have enough time to use data
I am able to adapt my own teaching practice based on data
I have access to data and results required to use data
Students characteristics have a larger impact on student achievement than my teaching
I have enough freedom to adapt my teaching based on data
Perceived Control (five point scale: completely disagree, disagree, neutral, agree, completely agree) α=0.69
I can decide for myself how much time I spend on data use
I can decide for myself whether I will use data or not
I can decide for myself in which way I will use data
Affective Attitude (five point scale: completely disagree, disagree, neutral, agree, completely agree) α=0.88
Data use is a waste of my time
In my opinion using data is interesting
In my opinion using data is a pleasant process

I like using data
In my opinion using data is important
Data use makes teaching easier
I'd rather teach based on my intuition than on data
Instrumental Attitude (five point scale: completely disagree, disagree, neutral, agree, completely agree) α=0.85
Data use can help address problems in my own classroom
Data use can help improve student achievement
Data use can help increase my self confidence
Data use can help improve the quality of education
Data use can help improve efficiency of education
Data use can help me with my professional development
Data about my students reflect the quality of my teaching
Data use makes me insecure
Selective Norm (five point scale: completely disagree, disagree, neutral, agree, completely agree) α=0.91
I use data because the head of my school considers this as important
I use data because the school board director considers this as important
I use data because my colleagues consider this as important
I use data because the Education Inspectorate considers this as important
Intention (five point scale: completely disagree, disagree, neutral, agree, completely agree) α=0.88
I am planning to use data
I am planning to participate in implementing data use in our school
I am planning to stimulate my colleagues to use data
I am planning to critically reflect on my teaching practice based on data
I am willing to adapt my teaching practice based on data
Data Use for Instruction (five point scale: completely disagree, disagree, neutral, agree, completely agree) α=0.94
I use assessment data for:
• Determining the learning objectives for my teaching
• Formulating learning objectives for individual students
• Determining students' progress
• Formulating learning objectives for a group of well-performing students
• Formulating learning objectives for a group of weak students
• Determining which elements students do or do not master
• Identifying weak students
• Identifying well-performing students
• Adapting my instruction to the needs of the students
• Determining which students can work independently
• Grouping students

• Referring students to remedial teaching or other forms of special help
• Extended teaching to weak students (individually or in groups)
• Researching why students make mistakes
• Extended teaching to well-performing students
• Offering extra learning material (individually or in groups) to well-performing students
• Offering a separate learning path with extra content for well-performing students
• Offering a separate learning path for weak students
• Planning how to adapt my teaching to weak and well-performing students in the group
• Determining instruction time per subject
• Determining teaching pace
• Selecting actions to actively involve students more in the learning content
• Selecting specific skills or topics that need to be explained more
• Determining extra homework
• Giving students feedback about the strategies they use
• Giving students feedback about their effort
• Determining which students I will check up on more during or after they have worked on the task
• Better structuring my lessons
• Improving my own lessons

Appendix B

Interview Questions

1. What academic areas you teach?
2. How do you determine the IEP goals?
3. Did you receive any PD or training on any assessment tools, and/or on DBI/DBDM?
    a. What did that training look like? An undergrad course? Inservice PD? Etc.
4. How do you monitor your students' progress for math/reading/writing?
    a. If no assessment is being used, ask: What do you do if you think that your students is not making a progress?
5. How do you determine which measure you will use to assess your students' performance?
    a. How confident you feel administering these measure?
    b. Did you think about using another assessment?
6. How frequently you measure progress? Do you think this frequency is enough for to determine whether they reach their IEP goals?
7. What could have made the data collection easier for you?
8. What do you do after you have the assessment results? (add questions for: if/how they summarize the data (e.g., through graphing) and how they use it to decide if they need to make instructional changes, plus how they decide what specific changes to make)
9. Do you have a system/place where you store the assessment results?
10. I see in the survey you mentioned that you use data for _____. Can you tell me more about how does it look like to use data for _____?
11. For which components of an instruction do you make changes mostly? Materials you use, the frequency of the instruction, duration of the instruction, number of students in a group, or something else?
12. How do you know when to stop doing an activity (a lesson, or a part of the lesson) with your students?