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Mathematics Teachers' Use of Assessment and Instructional Strategies

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This is to certify that the doctoral study by

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Walden University
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Abstract

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MA, Georgia Southern University, 2014

BS, Georgia Southern University, 2006

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

U.S. middle school teachers have struggled to meet the instructional needs of students in the area of mathematics. Teachers' approaches to assessment and instructional strategies remain understudied; such knowledge could help educational leaders to devise strategies to boost student achievement. The purpose of this qualitative study was to examine teachers' perceptions of assessment data usage and instructional strategies used in middle school mathematics. The conceptual framework was based on Fullan et al.'s three Ps (precision, personalization, and professional learning) framework. The guiding research questions for this study concerned teachers' perceptions of assessment usage and instructional strategies and their considerations prior to assessment and strategy implementation. This study was conducted in the basic qualitative tradition. Eight middle school mathematics teachers were recruited using criterion sampling. Individual interviews were conducted to gain insight regarding participants' perceptions of assessment usage and instructional strategies. Thematic analysis yielded six themes regarding the adequacy of time for analyzing data results, the realization that stakeholder input enhances classroom success, the use of varied instructional strategies, the use of data to support personalized instruction and to better understand students, and the implementation of instructional duties with fidelity. This study contributes knowledge regarding mathematics teachers' use of assessment data to improve instructional delivery and assessment. Study findings may inform classroom teachers' professional development in assessment data usage and instructional strategies. With such knowledge, teachers may have greater agency and be better able to increase student achievement.

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Dedication

With love, I dedicate this work to myself.

Then he touched their eyes, saying, “According to your faith be it done to you.”

Matthew 9:29

Acknowledgments

I reserved this space to acknowledge those who helped and inspired me to reach this ceremonious transition in my academic career. When I couldn’t find the words: I was carried by the wings of angels, inspired by the words of God, and blessed by my ancestors. When I lacked motivation: I was encouraged by my family and inspired by love. When I needed professional guidance, my cohort and doctoral committee supported me. I am both humbled and grateful.

Table of Contents

List of Tables

Chapter 1: Introduction to the Study

Assessment of student learning is a hallmark of contemporary U.S. education. The Every Student Succeeds Act (ESSA) of 2015 emphasizes the alignment of assessment and instruction (U.S. Department of Education, 2019). However, recent literature suggests that teachers' varied perceptions of instructional strategies and assessment usage poses an obstacle to implementing consistent, tailored instruction (Guay et al., 2017). Fullan et al. (2006) reasoned that precision, personalization, and professional learning (the three Ps), when fully developed, may lead to changes in teachers' beliefs, perceptions, and understanding of data usage to drive continuous improvement in student achievement. This study has the potential to advance positive social change by providing insight into assessment usage to inform instructional strategies; as Pinger et al. (2018) noted, the use of data-informed instructional strategies may boost student achievement. Chapter 1 serves as an introduction to the study. It consists of the background, problem statement, purpose of the study, research questions (RQs), conceptual framework, nature of the study, definitions, assumptions, scope and delimitations, limitations, significance, and chapter summary.

Background

Assessment data have the potential to inform how teachers plan and differentiate instruction. However, some teachers struggle to use assessment data (Datnow et al., 2021). Moreover, how teachers leverage assessment data to inform instructional decisions is relatively unknown (Datnow & Hubbard, 2015). This lack of knowledge represents a gap in practice. Some U.S. classroom teachers are struggling to interpret lapses in

understanding shown in student performance levels (McGlynn & Kelly, 2017), specifically in mathematics. A teacher's ability to accurately diagnose and prescribe remediation for students positively affects student achievement in mathematics (Deunk et al., 2018). Teachers who are less skilled in interpreting lapses in student performance often have trouble implementing appropriate and consistent interventions (Prast et al., 2018).

In conducting this study, I sought to contribute to a growing body of knowledge concerning how teachers use assessment data to inform instruction. This study may be of use to the educational field because it provides insight into teachers' assessment data use. Specifically, I examined teachers' perceptions of assessment data usage and instructional strategies. The targeted content area was middle grades mathematics.

Problem Statement

The problem that prompted this dissertation is that some U.S. middle school teachers struggle to implement effective instructional strategies based on students' assessment data in mathematics. I sought to address this gap in professional practice by contributing to a growing body of knowledge about how teachers use assessment data to inform instructional strategies. In comparison to 2009, national average scores in eighth grade mathematics continue to lag for lower and middle performing students based on the 2019 National Assessment of Educational Progress mathematics assessment report (The Nation's Report Card, 2021). These lagging deficits may be due to teachers' inability to diagnose and prescribe remediation for students accurately. Similarly, Raffe and Loughland (2021) gathered data on teachers' perspectives to examine the factors

affecting teachers' use of assessment data. Lack of confidence and skill level required to collect and analyze assessment data properly were among the 16 factors identified.

Furthermore, teachers lack the skills to interpret lapses in student performance data, contributing to difficulties in implementing appropriate and consistent interventions (Prast et al., 2018). To emphasize, only 25-50% of U.S. teachers use student assessment data to inform instruction (Kippers et al., 2018). Schildkamp (2019) noted that more information about how teachers use assessment is needed. More recently, Datnow et al. (2021) reported that teachers struggle to use data to inform daily instruction. This continued interest in teachers' assessment data usage to inform instruction demonstrates a gap in professional practice.

Purpose of the Study

The purpose of this qualitative study was to investigate middle school teachers' perceptions of assessment data usage and instructional strategies in mathematics. Exploring teachers' perceptions may improve understanding of their assessment and instructional practices. I examined teachers' perceptions regarding assessment usage and instructional strategies to address a gap in practice concerning how teachers are using assessment data to inform instruction.

Research Questions

I sought to answer the following RQs in this study:

RQ1: What are middle school mathematics teachers' perceptions of assessment data usage?

RQ2: How do middle school mathematics teachers choose personalized instructional strategies based on students' assessment data?

Conceptual Framework

Fullan et al. (2006) deemed that precision, personalization, and professional learning (the three Ps), when fully developed, may lead to changes in teachers' beliefs and understanding towards improving student learning. I based the study's conceptual framework on the three Ps because they may provide a plausible mechanism for understanding how teachers can effectively use assessment data. The data I collected from the participants regarding their perceptions were interpreted in relation to Fullan's principles. The core concepts of the three Ps model are based upon teachers providing precise and personalized instruction that is valid and data driven. The three Ps may help teachers transmute their classroom experiences while dramatically and sustainably raising student performance levels based on effective assessment data usage. Therefore, it is an apt choice to frame this study. The study's conceptual framework provided the overall structure in which I developed and refined the RQs and interview protocols (see Ravitch & Riggan, 2016). Additionally, the study's framework helped me to achieve my research purpose as it was used to frame and interpret the scholarly answers to the RQs.

Nature of the Study

I selected the qualitative paradigm for this study because exploring participants' perceptions was needed to understand the social aspects of the study phenomenon (see Merriam, 2009). When collecting and analyzing data, a researcher chooses either an empirical quantitative approach or a subjective qualitative approach based on the study's

overall purpose. Researchers who engage in qualitative data analysis aim to uncover emerging themes, patterns, insights, and understandings through inquiry (Patton, 2015). In contrast, those performing quantitative analysis scrutinize the frequency of data and the relationships between study variables (Merriam, 2009). Therefore, the quantitative paradigm was not a good fit for this study's purpose, which was an in-depth understanding of participants' perceptions.

Defining a study's main objective is essential to understanding the data collected (Singleton & Straits, 2005). The qualitative paradigm offers a more detailed analysis of a phenomenon by providing insight into the participants' experiences within their natural setting (Merriam, 2009). Because the researcher is the primary tool for data collection in a qualitative study, they can provide more meaningful explanations of data (Merriam, 2009). My focus on understanding teachers' perceptions of the study phenomena made qualitative methods more apt for this study.

I used a basic qualitative approach to conduct this investigation. The research design should be reflective of the study's purpose (Yin, 2014). Merriam (2009) described the overall purpose of a basic qualitative research study as providing insights into participant experiences and perceived interpretations of experiences. The research setting was middle schools in the United States. The population of study participants included teachers responsible for implementing the mathematics curriculum.

Definitions

Every Student Succeeds Act (*ESSA*): A U.S. federal law enacted in 2015 that focuses on improving primary and secondary education for students in low-income

populations, with an emphasis on college readiness, retention rates, and graduation rates (U.S. Department of Education, 2019).

Formative assessment: A planned or impromptu process in which educators use tasks to diagnose students' current understanding and provide a metric for modifying teaching and learning to bridge instructional gaps (Chappuis et al., 2021).

National Assessment of Educational Progress: A congressionally mandated project administered by the U.S. Department of Education; the exam is the largest nationally ongoing assessment of student performance in the United States (The Nation's Report Card, 2021).

Summative assessment: A type of assessment that is used as a metric for what a student has learned at the end of an instructional period (Chappuis et al., 2021).

Assumptions

According to Creswell and Creswell (2017), assumptions are facets of research that are presumed but not established as accurate. Principle assumptions exist in all research designs (Creswell, 2013). In this study, I assumed that participating teachers consistently implemented the adopted curriculum. Another assumption was that participating teachers regularly collect students' formative and summative assessment data. In addition, I assumed that teachers' general understandings and perceptions of assessment usage and instructional strategies directly reflect student achievement. Last, it was a necessary assumption that, in my role as the researcher, I would be able to remain neutral regardless of the investigation outcome.

Scope and Delimitations

A study's scope establishes the parameters observed within the study (Creswell & Guetterman, 2019). This study included data collected from middle grades teachers throughout the United States. Therefore, the demographics of participants varied. However, participants shared a commonality in that only certified teachers in the content area of mathematics were eligible to participate. Delimitations establish the confines and controls for a study (Denscombe, 2013). A delimitation to this study was that eligibility was bound to only active, certified teachers. Therefore, retired teachers who did not have active certificates were excluded from this study. Interviews with participants took place during designated times.

Limitations

The limitations of a study stem from its research design. A qualitative approach allows the researcher to derive meaning relative to the phenomena of interest via implementing unstructured and semistructured data collection methods, such as interviews (Creswell & Creswell, 2017). I selected participants based on their content area and certification status. A limitation of this study was the potential for bias because I interviewed individuals working in the same teaching profession as me. However, the interview protocol for this study was vetted by my doctoral committee and subject matter experts to address this limitation. Another limitation of the research is that the data findings may only be generalizable to the middle school mathematics teachers' population. As Simon and Goes (2013) noted, basic qualitative studies include small test groups that may not reflect larger populations. The limitations of a study may also be due

to issues that are outside of the researcher's control but nonetheless limit research generalizability (Creswell & Guetterman, 2019). For example, little interest in a proposed study could become a limiting factor. The small sample size of the current research may therefore be a limitation.

Significance

In this study, I addressed U.S. teachers' approaches to assessment and instructional strategies. Teachers' varied perceptions of instructional strategies and assessment usage pose an obstacle to implementing consistent, tailored instruction (Guay et al., 2017). The beneficiaries of this research may be the students, classroom teachers, and learning institutions nationwide. The students may benefit the most because when meaningful assessments are timed appropriately, student performance increases, and student performance anxiety decreases (see Agboola & Hiatt, 2017). Second, classroom teachers may benefit from an increased understanding of lapses in student performance levels; specifically, they may be able to use this understanding to revise instructional strategies and future assessment use (see McGlynn & Kelly, 2017). Finally, middle schools may yield a higher letter grade rating on the National Assessment of Educational Progress report card due to increased student growth levels on standardized tests. In addition to the study's implications for positive social change and teaching practice, this study may constitute a useful expansion of the limited knowledge concerning how teachers use assessment data to inform instructional strategies.

Summary

In Chapter 1, I identified a national problem: U.S. teachers' struggles to implement effective instructional strategies based on students' standardized assessment results in middle grades mathematics. The purpose of this basic qualitative study was to gain an understanding of middle school teachers' perceptions of assessment and instructional strategies for mathematics. The guiding RQs centered on middle school teachers' perceptions of assessment data usage and how middle school mathematics teachers choose personalized instructional strategies based on students' assessment data. For the conceptual framework, I used the strategies for continuous educational improvement developed by Fullan et al. (2006), based on the three-P model of personalization, precision, and professional learning.

Next, in Chapter 2, I review literature about the following topics: (a) the history of assessment, (b) assessment usage as a strategy, (c) teachers' perceptions of assessment, (d) frequency of assessment, (e) history of personalization models (f) diversification of instructional strategies, (g) teachers' knowledge and beliefs related to assessment, (h) personalization instructional strategies, (i) goals of personalized assessments and strategies, (j) differentiation to raise student achievement, and (k) effective differentiation in mathematics. The literature review supports the selection of the three-Ps model as the study's conceptual framework. Furthermore, the scholarly articles, books, and dissertations examined for this literature review help provide context for this study.

Chapter 2: Literature Review

The problem that prompted this dissertation was that some U.S. middle school teachers struggle to implement effective instructional strategies based on students' assessment data in mathematics. The purpose of this qualitative study was to examine teachers' perceptions of assessment data usage and instructional strategies used in mathematics at the national level. Exploring teachers' perceptions may improve understanding of trends in student achievement. In this chapter, I review the literature on teachers' assessment usage and selection of instructional strategies. Before reviewing the literature, I describe the literature search strategy and the conceptual framework for the study.

Literature Search Strategy

To explore teachers' use of assessment and instructional strategies, I selected literature based on its relevance to the following themes: teachers' understanding and usage of assessment, selection of instructional strategies, and frequency of assessment. The literature review consists of research and data pertaining to teachers' use of assessment and instructional strategies that support student achievement. Multiple sources, including government reports, peer-reviewed articles, and books, were used to gain insight into the investigated phenomenon. I obtained peer-reviewed sources from the Walden University electronic databases, including SAGE Journals, ERIC, and other academic sources. I used the following keywords to search the databases: *assessment usage*, *use of assessment*, *instructional strategies*, *teacher perception*, *formative*

assessment, *classroom strategies*, and *differentiated instruction*. I also reviewed the works referenced in sources to identify other relevant articles.

Conceptual Framework

Fullan et al. (2006) deemed that precision, personalization, and professional learning (the three Ps), when fully developed, may lead to changes in teachers' beliefs and understanding related to improving student learning. I based the study's conceptual framework on the three Ps because this framework may provide a plausible mechanism for understanding how teachers can be effective in delivering instruction and assessment data usage. The data collected from the participants regarding their perceptions were interpreted in relation to Fullan's principles. Research indicates that many students lack competency in mathematics due to subpar teaching methods inconsistent with the current education setting (Hanushek et al., 2019). The practical implications for teacher effectiveness are that implementing the three Ps could enhance the precision of assessments by helping teachers make pedagogic decisions against a backdrop of data that encapsulates the students' academic profile. Further theoretical implications for teacher assessment usage are that providing personalized instructional strategies may minimize learning barriers in a heterogeneous learning environment (see Fullan et al., 2006). As students complete assessments, teachers should provide frequent, specific, and personalized feedback (Pinger et al., 2018). Moreover, teachers' continuous professional learning and pedagogic development lead to better student learning outcomes and opportunities (Fullan et al., 2006).

Following Fullan et al.'s (2006) initial development, the theory of the three Ps has proven useful as the conceptual or theoretical framework for a number of studies that have provided empirical evidence in support of the model. For instance, McLoughlin and Lee (2008) reported on teachers' use of informal discussions with students to determine student strengths and weaknesses. This alternative form of assessment allows teachers to be more precise and intentional with their lesson planning based on the precise use of data to personalize instruction. McLoughlin and Lee further reported on teachers' use of a wiki-based encyclopedia to help students establish and maintain encyclopedia entries on various subjects. The authors concluded that teachers' autonomized learning approaches helped students achieve their personalized goals.

Moreover, implementing the three Ps in Australia and Canada significantly affected students' mathematics performance, resulting in a 10-20% improvement over several years (Swan, 2017). In another Australian study, researchers used the three Ps model to evaluate a mathematics intervention program based on primary grades students' mathematics performance and overall disposition for learning (Gervasoni et al., 2021). The Australian study's findings confirmed the interventions successfully closed student achievement gaps in mathematics. McLoughlin and Lee (2008) examined the three Ps of pedagogy to rethink teaching and learning models and understand how teachers can support students toward reaching higher education competencies. This study showed that personalization, when fully realized creates a potential for transformational shifts in teaching and learning practices. Similarly, Arnesen et al. (2019) concluded that teachers who use the three Ps approach to align tasks and assessments to students' personalized

needs saw increased student confidence levels in mathematics. According to the study's results, students who received customized assessments had a greater interest in mathematics and were more confident in their abilities.

A premise of the three Ps model is that teachers provide precise and personalized instruction that is valid and data driven (Fullan et al., 2006). The three Ps may help teachers transmute their classroom experiences while dramatically and sustainably raising student performance levels (see Fullan et al., 2006). Therefore, it was an apt choice to frame this study.

Literature Review Related to Key Concepts and Variables

History of Assessment in Education

Since the late 1960s, assessment has been pivotal in how U.S. students learn and their motivation to learn. Equally important, assessment has become essential to how teachers teach. Scriven (1967) first coined the term *formative evaluation* as a continual means of influencing student achievement. Bloom (1968) elaborated on formative evaluation and its inherent link to summative evaluation. Scriven's distinction between formative and summative assessment was instrumental in reforming evaluation in the mid-19th century; however, an unintended dichotomy developed as formative and summative assessments were viewed in contrast to the other instead of harmoniously (Lau, 2016).

In their seminal work, Wiliam and Black (1996) expanded the role of assessment to include students as an integral part of the assessment feedback loop. Formative assessment is a graphic and multi-interpretive means for teachers and students to navigate

the teaching and learning process. Teachers engage in assessment feedback to elicit the evidence needed to inform and adjust instruction (Black & Wiliam, 1998; Bloom, 1969). Moreover, the teacher reconstructs assessments according to their classroom environment. Comprehension continuously evolves in a classroom environment. A teacher's use of assessment and reflexive, timely feedback helps identify and address learning gaps (Black & Wiliam, 2004). Improvement occurs when teachers gain new meaning using a reflective analysis of instructional innovations (Fullan, 2007). Assessment should benefit students during the learning process by allowing teachers to recognize and respond to learning and deficit cues (Schildkamp, 2019). In essence, the assessment-feedback loop activates students' learning by enabling them to apply the data generated meaningfully (McMillan, 2018).

The No Child Left Behind Act of 2001 brought assessment practices to the fore of public discussion across the United States (Popham, 2013). The No Child Left Behind era ushered in yearly standardized testing that was designed to determine academic progress. These assessments were performed summatively; however, there were growing concerns regarding the need for frequent progress monitoring (Popham, 2013). Using formative assessments allowed teachers to track better their students' instructional deficits (Connors, 2021). Black and Wiliam (1998) posited that teachers would require pedagogical upgrades to implement formative assessments effectively. Moreover, assessment practices are enhanced when teachers participate in learning communities focusing on improving teaching and learning (Fullan, 2011).

Accountability became the focus of measurement with the passage of ESSA in 2015. Federal law requires U.S. schools to adhere to rigorous accountability measures while preparing students for postsecondary education and careers (U.S. Department of Education, 2019). Under ESSA, officials also score schools based on graduation rates, retention rates, and the implementation of college and career readiness standards in addition to the Common Core standards (Urick et al., 2018). ESSA has placed tremendous stress on teachers and principals due to the multiple federally mandated accountability measures (Reed & Rose, 2018). According to Davis et al. (2018), teachers were not adequately prepared to implement the Common Core standards. Moreover, in 2016, 33% of middle school mathematics teachers struggled to name the standards for mathematical practice and often misinterpreted the standards (Davis et al., 2018).

Teachers are expected to gather and generate student data for instructional purposes. This practice of data-driven decision-making (DDDM) involves monitoring student progress through assessment and making informed instructional decisions (Schildkamp & Datnow, 2020). Additionally, analyzing student data using DDDM skills helps teachers to identify instructional gaps (Mandinach & Schildkamp, 2020). DDDM is most effective when teachers translate students' assessment data into meaningful practice. Moreover, teachers can include students when establishing and implementing instructional goals, which allows the student to play an active role in the DDDM monitoring process (Mandinach & Schildkamp, 2020).

Assessment as a Strategy

Assessment is embedded in the process of learning. Students who take practice tests perform better than those who only review course content (Adesope et al., 2017). According to Adesope et al., students who took practice tests outperformed those students in non-testing learning environments. Still, there was limited information regarding whether such tests enhance or reduce student learning. The most crucial assessment component is interpreting and using the information garnered for its intended purpose. Teachers' use of informal formative assessments affects student learning and teachers' recognition of learning gaps (Lekwa et al., 2020). For example, reflection, analysis, and real-time interaction are effective tools that can be used to guide informal formative assessments (Lekwa et al., 2020). Pre- and post-testing are useful means of benchmarking student growth. Moreover, pre-testing promotes significant content retention, whereas post-testing provides an effective bridge toward related untested content (Latimier et al., 2019).

Both teachers and students benefit from apt assessment usage. Therefore, understanding assessment usage as a strategy to inform students and teachers in practice is essential to sustainable growth in student and teacher performance (Adesope et al., 2017). When teachers assess students' understanding and adjust their instruction to rectify misconceptions, it helps students to realize their academic goals. This apt usage of assessment increases student achievement (Andersson & Palm, 2017). Assessments of and for learning allow teachers to assist students' learning endeavors structurally. Furthermore, a teacher's capacity to aptly use assessment data is directly proportional to

student achievement (Toropova et al., 2019). Therefore, higher levels of teacher capacity yield higher levels of student achievement.

Frequency of Assessment. Analyzing students' achievement provides insight into formative assessment intervention efficacy (Pinger et al., 2018). As students complete assessments, teachers should provide frequent, specific, and personalized feedback (Pinger et al., 2018). On the other hand, nonspecific and infrequent feedback has a negative effect on students' mathematic achievement (Pinger et al., 2018). However, when teachers provide frequent feedback that is embedded within instruction, with an emphasis on feedback use, mathematics achievement is positively affected (Pinger et al., 2018). Gaps in teacher understanding may contribute to the low frequency usage of certain assessments (Johnson et al., 2019). Limited data literacy reduces teacher agency (Jimerson et al., 2021).

Additionally, assessments that occur within and between lessons, referred to as medium cycle assessments, are valid observation tools for mathematics and literacy teachers (Lee et al., 2020). Assessments during medium cycle grading periods are beneficial for students by detecting gaps in knowledge, which provide teachers the feedback needed for adjusting instructional strategies (Lee et al., 2020). This method is a valid and reliable metric for implementing formative assessments in the classroom (Lee et al., 2020).

Teachers' Perceptions of Assessment

Teacher perceptions, beliefs, and understandings about assessment impact assessment practices and implementation (Cotton, 2017). A teacher's perceptions

regarding the efficacy and use of assessment influence assessment practices (Tomlinson, 2017). Although teachers may understand assessment practices, some still opt not to employ certain formative assessment measures despite receiving training (Cotton, 2017). Opting not to employ a variety of assessments could be due to how teachers perceive their abilities as assessors (Cotton, 2017). By the same token, Van Gasse et al. (2020) reported that teacher attitude and perceived self-efficacy affect how teachers use data. Classroom observations revealed that teachers generally used the same classroom strategies, but master teachers implemented assessment strategies more effectively (Johnson et al., 2019). With adequate support, teachers can adjust instruction, implement effective assessments, and modify summative assessments (Yin & Buck, 2019). Moreover, reducing the number of classroom activities while implementing diverging and converging assessments helps students build ideas over time (Yin & Buck, 2019).

Teachers may be experiencing a diminishing agency to assess student needs due to using mandated assessments instead of teacher-authored assessments (Golden, 2018). Perhaps teachers feel pressured or threatened to assess their students in a particular way, thereby reducing teacher agency concerning compliance (Golden, 2018). Some teachers may struggle to create meaningful assessments because mandated assessments fail to provide a detailed profile of student growth (Golden, 2018). Reduced autonomy in curricular decisions about assessment contributes to a diminishing agency to assess student needs (Golden, 2018). Furthermore, agency in mathematics teaching often lags teacher mindset and ability to aptly explicate students' needs (Bobis et al., 2019).

Diverse Instructional Strategies

Assessment feedback helps teachers to make informed instructional decisions. Ideally, teachers can address learning deficits by implementing instructional strategies specific to the learner's needs (McGlynn & Kelly, 2017). Moreover, the diversification of instructional strategies is directly correlated to higher achievement (Clements et al., 2020). However, teachers use a greater variety of assessments in a student's early learning phases instead of later learning phases (Clements et al., 2020). Moreover, student learning experiences, particularly in mathematics, become increasingly homogenous during later learning phases (Clements et al., 2020). Likewise, science teachers struggle to raise students to mastery level in learning and applying new scientific words for newly introduced concepts; vocabulary instructional strategies enhance content-area teacher effectiveness (Rasinski et al., 2017). Furthermore, a constructivist approach to curricular strategies may better promote literacy (Nguyen et al., 2018). When coupled with targeted, content-specific instruction, this approach is most effective for the whole learner (Nguyen et al., 2018).

Additionally, genre-specific instruction methods have proven to be an effective template for advancing discipline discourse between students and teachers (Rappa & Tang, 2018). Content area teachers' discussion approaches and strategies become a dynamic between raising awareness about discipline discourse and facilitating the development of genre-specific discourse when genre-specific methods are used effectively (Rappa & Tang, 2018). Formative data assist teachers in determining diversified instructional strategies to meet the individual needs of students (Rappa &

Tang, 2018). Despite the emphasis on data-based instruction, student achievement in mathematics has remained low, raising concerns regarding how teachers use assessment feedback data to inform instruction (Datnow et al., 2021). For example, using homework to assess students' competencies may be a cause for debate, with data indicating misalignment between what educators deem characteristic of quality homework and the assigned homework characteristics (Rosário et al., 2019). For teachers to select meaningful assessments that maximize students' learning experiences, teachers may benefit from reevaluating their perceptions about the characteristics of quality work. (Rosário et al., 2019).

Teachers' Understandings and Beliefs

Ascertaining teachers' experiences, beliefs, and knowledge is critical to implementing instructional strategies with students (Rillero, 2016). A link exists between teachers' professional development and instruction effectiveness (Gonzalez & Maxwell, 2018). Furthermore, teachers' perceptions, beliefs, and content knowledge directly influence the degree of efficacy pertaining to instruction. When teachers make professional gains as career learners, their confidence in their instruction ability will increase (Kuehnert et al., 2019). Valiandes and Neophytou (2018) argued that teacher education has little influence on teachers' perceptions and beliefs. Instead, the authors posited that personal experiences, school culture, and observations are more influential in shaping teachers' perceptions and beliefs on assessment and instructional strategies. Moreover, the authors also concluded that teachers' motivation to differentiate lessened when encountering increased implementation struggles. Equally important, teachers'

reflections on their perceptions, beliefs, and understandings can help improve the instructional strategies' effectiveness (Tanyer, 2017). The educators' beliefs may affect the way they approach a topic. Specifically, a teacher cognizant of bias towards a particular topic within the curriculum must be cautious of projecting that bias upon students. Teachers with a fluid mindset have more potential for professional growth; this growth is transferrable to students (Seo & Lee, 2020). Moreover, when teachers take the time to reflect on their understandings and beliefs regarding assessment and instructional strategies, this effort may cause a shift in their perceptions that may ultimately improve teacher and student performance (Tanyer, 2017). Effective instructional strategies require highly adaptable teachers who can adjust to an ever-changing educational arena via innovative instructional practices. Teachers who employ relevant instructional strategies are more equipped to meet the student at their current levels of learning; however, some teachers feel constrained in their ability to provide substantive assessments (Rillero, 2016).

History of Personalization Models

Increasing classroom diversity has caused teachers to shift their instructional practices towards more differentiation (Darling-Hammond, 2006; Santangelo & Tomlinson, 2009). Over the years, personalizing instructional strategies and assessments as a form of differentiated instruction has expanded as a globally recognized instructional practice (Chamberlin & Powers, 2010; Lawrence-Brown, 2004; Tomlinson et al., 2003). There are numerous proposed structures and components of differentiation. However, the works of Tomlinson (2017), Hall (2002), and Lawrence-Brown (2004) are the most well

known (Pozas & Schneider, 2019). Differentiation through personalization is highly influenced by the classroom teacher's understanding and beliefs (Tomlinson, 2005, 2014, 2017). Teachers' beliefs, attitudes, and understandings refer to the intrinsic mindsets possessed by those facilitating the learning process (Seo & Lee, 2020). Ultimately, these beliefs may hinder strategy implementation efficacy and student success (Paek & Sumners, 2019). Flexible learning environments where teachers are responsive to student needs enable students to sharpen their existing skills toward competency (Sousa & Tomlinson, 2011). Tomlinson (2017) proposed that teachers could improve student achievement by differentiating process, content, and product. Differentiating the process pertains to personalizing learning activities tailored to the student's needs. Content may be differentiated according to the content introduced to the student. Likewise, student readiness levels can inform teacher choice of assessment products. The goal is to maintain rigor while providing personalized instruction for each student. To achieve this outcome, teachers should maintain detailed profiles of each student to facilitate differentiation through personalization (Tomlinson, 2017).

Hall (2002) suggested using preassessments as the strategic fulcrum for differentiation and personalization. This method allows teachers to collect insight regarding student interests, understandings, and current skill levels before beginning a new unit (Coubergs et al., 2017). These preassessments can be conducted formally or as an impromptu student readiness survey. In this manner, assessments are used as a diagnostic tool rather than a mere measure of outcomes (Puzio et al., 2020). Moreover, learning targets and objectives should be communicated clearly to students. Once

learning objectives are delineated to students, teachers may customize lessons for students according to their learning profiles (Hall, 2002; Tomlinson, 2014). Lawrence-Brown's (2004) model uniquely established a set of criteria defining minimum proficiency for struggling learners while emphasizing the importance of personalizing instruction for the enrichment of high achievers. This model relied upon curricular adaptations to meet standards per category of learner. In contrast, Hall (2002) and Tomlinson (2017) proposed modifications to the process, content, and product based on each learner's assessed needs.

Personalized, student-centered learning has been promoted as the focal point of reformation across the education system. Allowing students to play a role in their learning is an effective practice that supports student efficacy (Bernacki & Walkington, 2018; Reber et al., 2018). Allowing students to solve problems using inquiry-based learning models promotes engagement and gives meaning to scholastic objectives. Autonomous learning methods for students are widely used in other disciplines; however, the implementation of autonomous methods to personalize students' learning tends to be used less often in middle school mathematics (Walkington & Bernacki, 2019). Establishing personalized systematic approaches for mathematics students remains a central topic of interest for many researchers and stakeholders (Walkington & Bernacki, 2015, 2019). Technological platforms that personalize instruction based on student ability, degree of prior knowledge, interest, preferences, and goals are changing classroom dynamics by adapting to students' individual needs. Unfortunately, many

middle school mathematics teachers feel constrained by rigid curricular boundaries that do not fully utilize personalization models (Walkington & Bernacki, 2015).

Personalized Instructional Strategies

Adapting and modifying assessments and instructional strategies to better meet students' needs is a form of differentiating instruction (Letwinsky, 2017). Differentiated instruction necessitates teachers to allot students to access, develop, and demonstrate skills through thoughtful planning (Goddard et al., 2019). Instructional strategies and assessments can be modified according to student readiness and interests (Dennis & Gratton-Fisher, 2020). Differentiating instruction through personalization helps cultivate authentic and engaging student learning experiences while adhering to a rigorous curriculum. However, for a teacher to personalize content without changing the rigor level, the teacher must have the sufficient content knowledge and the flexibility to work with a wide range of learners (Neuman & Danielson, 2020). If teachers are to provide higher efficacy of instructional strategy implementation, more emphasis should be placed on teacher content knowledge. Also, appropriately timed assessments can help teachers make informed decisions regarding preparing personalized instructional strategies (Dennis & Gratton-Fisher, 2020).

In recognition of student diversity, personalizing instruction as a process affects teacher choice of instructional strategies, accommodating student learning (Smith & Williams, 2020). Subtle differences in instructional practices and strategies often yield substantially different student learning outcomes (Donaldson et al., 2017). Personalization honors student individuality, which may positively affect student

motivation (Haymon & Wilson, 2020). Moreover, a lack of individualized instructional strategies, assessments, and learning activities may be the culprit for underachieving students (Siegle & McCoach, 2018). Classroom environments that offer a choice of assessment allot student autonomy, which inspires student interest (Haymon & Wilson, 2020). Therefore, it is incumbent upon the teacher to help students identify their unique abilities by cultivating an environment that celebrates choice.

Goals of Personalized Assessment and Strategies

The goal of personalized assessments and instructional strategies is to raise students' academic potential while addressing individual needs. Moreover, teachers' assessment products and instructional strategies are designed to meet each learner's needs, which may lead to student gains (Ozan & Kincal, 2018). Therefore, the teacher makes an informed decision per the student profile (Fullan et al., 2006). Adhering to rigor, teachers engage student performance by cultivating a positive learning environment where heterogeneity is welcomed (Pozas & Schneider, 2019). Diagnostically, the teacher will determine the degree of differentiation or personalization needed regarding pace, content, process, and product (Tomlinson, 2017, 2020).

Ultimately, a teacher's overall aim when administering any assessment or instructional strategy is to analyze and interpret student performance to determine areas for improvement. Teachers can determine the necessary instructional adjustments based on student performance to develop a precise action plan. However, Trumbull and Nelson-Barber (2019) suggested that using assessment data to make instructional adjustments continues to be a struggle for teachers, especially considering the full learner profile per

student. The most arduous task for teachers is to target student deficits and close instructional gaps once diagnosed (Trumbull & Nelson-Barber, 2019). Moreover, Kruse et al. (2017) reported that math teachers had acknowledged the need for support concerning differentiated practices.

The modern-day classroom features a heterogeneous mix of students with varied learner profiles (Tomlinson, 2017, 2020). Teachers must navigate these differences while drawing on students' preferences and prior knowledge as a driving force for personalization. Uniquely learning each student's needs will allow for more precision when personalizing assessments and instructional strategies (Fullan et al., 2006). This tool requires teachers to be continually involved in the teaching and learning process.

Differentiation to Raise Student Achievement. Various opinions exist on the benefits of differentiation. At any rate, research reveals that differentiation assists all students' learning endeavors (Prast et al., 2018). As a teaching strategy, differentiation provides instructional support for beginning and developing learners while allowing the teacher to scaffold instruction to multiple levels of rigor (Brigandi et al., 2019). According to Gavin and Renzulli (2021), the effects of differentiation on students' mathematic achievement are statistically significant. Technology is assistive in the planning and implementation of differentiation. Teachers use technology to diagnose when differentiation is needed and enhance instruction using technological applications (Beasley & Beck, 2017). Also, providing students with laptop computers allows students to have access to classroom resources outside of school. This strategy helps teachers to establish a blended learning environment where students can reinforce classroom

instruction beyond school hours. Gokcearslan (2017) reported students' perspectives of blended learning to be positive concerning facilitating extended learning through technological applications. Therefore, differentiating instructional practices using technology is an efficient method for promoting student engagement. However, technology-based methods are not one-size-fits-all. This technology-based approach still requires teachers to be cognizant of students' present learning levels to best tailor an instructional pathway for learning (Gokcearslan, 2017).

Effective Differentiation in Mathematics

According to Russo et al. (2021), differentiation in mathematics is a challenging task at all levels of education. Furthermore, information regarding how teachers attempt to differentiate is insufficient. However, some teachers notice gains among low-performing students when implementing advanced mathematical topics previously deemed beyond the grasp of below proficient learners (Coles & Brown, 2021). The method of teaching beyond the student's current performance level helps to dissolve dichotomous grouping while providing intensive differentiation for all students (Gervasoni et al., 2021). Moreover, a teacher's ability to denote a task's potential to differentiate effectively differs according to the level of expertise (Bardy et al., 2021). Bardy et al. (2021) found that teachers are less sensitive to designating the specific adaptations of a task. Instead, teachers were more concerned with tasks' superficial structuring and layout. The results of the authors' study imply that teachers may need development to realize the potential of differentiation fully. Lambert et al. (2021) proposed two perspectives, universal design for learning and design thinking, to broaden

teachers' viewpoints of differentiated instruction. The authors designed a course to support teachers in designing experiences and structures that would help them reimagine their role as both facilitators and designers of high quality, extracurricular experiences crafted to raise student achievement. The results of the authors' study revealed that teachers' use of universal design for learning and design thinking strategies helped them to cultivate multiple means of engagement and representation, thus making learning more meaningful for mathematics students. However, Mellroth et al. (2021) concluded that teachers positioned as designers often face the dilemma of guiding instead of funneling content. The authors proposed professional development as a solution to the problem. Ultimately, task design and effective implementation are a product of teacher knowledge and expertise (Herner-Patnode & Lee, 2021).

Overall, mathematics has been treated as a static subject leaving little room for targeted and personalized instruction as student learning experiences become increasingly homogeneous during later learning phases (Clements et al., 2020). As illustrated by Reed and Rose (2018), federally mandated accountability measures continue to place strain on mathematics teachers. As a result, it is more important than ever for teachers to develop the knowledge and expertise required to become designers of high-quality, differentiated instruction (Mellroth et al., 2021).

Summary and Conclusions

In Chapter 2, I reviewed literature about the following topics: (a) research about the history of assessment, (b) assessment usage as strategy, (c) teachers' perceptions of assessment, (d) frequency of assessment, (e) history of personalization models (f)

diversifying instructional strategies, (g) teachers' understandings and beliefs, (h) personalizing instructional strategies, (i) goals of personalized assessments and strategies (j) differentiating to raise student achievement, and (k) effective differentiation in mathematics. In Chapter 3, I describe the research design and methodology and the study participant selection process. Likewise, I describe how the study addresses ethics, data collection, and analysis.

Chapter 3: Research Method

In Chapter 3, I discuss the methodology employed in this study. Additionally, I describe the study's trustworthiness and the ethical procedures I followed. The purpose of this basic qualitative study was to examine teachers' perceptions of assessment usage and instructional strategies used in middle school mathematics. This study was conducted because teachers' perceptions of assessment data usage and instructional strategies are unknown. Moreover, some teachers simply do not know how to use assessment data to inform instructional practice (Datnow et al., 2021). I sought to answer the following two RQs in the study:

RQ1: What are middle school mathematics teachers' perceptions of assessment data usage?

RQ2: How do middle school mathematics teachers choose personalized instructional strategies based on students' assessment data?

Research Design and Rationale

In conducting this study, I followed the basic qualitative tradition. In a basic qualitative study, a researcher interprets personal experiences within social constructs (Merriam & Tisdell, 2016). Using this approach, I allotted meaning to teachers' personal perceptions and understandings of assessment and instructional strategies at the middle school under study. Detailed descriptions of the participants' perceptions and understandings are needed so that teachers can make informed decisions toward narrowing achievement gaps. Therefore, I chose to use a qualitative approach to

understand how teachers' usage of assessment data and selection of instructional strategies may relate to student achievement (see Yin, 2016).

The researcher plays a pivotal role in the data collection process in a qualitative study (Creswell, 2013; Merriam & Tisdell, 2016; Yin, 2016). For this study's purposes, I gathered information directly from the participants via interviews to ascertain their perceptions regarding assessment data usage and the selection of instructional strategies. Qualitative data may be derived from various sources (such as observations or interviews) for integrative purposes (Crossman, 2019; Yin, 2016). Qualitative researchers use inductive reasoning to determine the thematic nature of the collected data through categorization to develop a richer understanding of the study problem. This inductive approach in qualitative research helps a researcher to cultivate broader concepts (Yin, 2016). As concepts emerged from data analysis, I identified themes that gave meaning to the participants' data. These themes helped to establish meaning from participant data, which is the focal point in qualitative research (see Yin, 2016). By examining teachers' perceptions of assessment data usage and instructional strategies, I sought to produce relevant and useful information that teachers may use to make informed instructional decisions in mathematics.

Alternative research methodologies might include quantitative and mixed-methods study designs. The quantitative paradigm examines relationships between numerical variables (Glesne, 2016). In contrast, a mixed-methods paradigm integrates qualitative and quantitative approaches for increased reliability (Crossman, 2019). The quantitative and mixed-method approaches did not align with this study's purpose and

guiding RQs. I did not aim to identify a cause or effect or quantify variables. Furthermore, these approaches require larger sample sizes for reliability purposes (Crossman, 2019). For this study, I conducted interviews to investigate the participants' perceptions regarding the phenomenon rather than the phenomenon itself (see Crossman, 2019; Glesne, 2016; Merriam & Tisdell, 2016). A basic qualitative design was appropriate for the study purpose.

Role of the Researcher

The researcher collects and analyzes the information using inquiry-based, inductive reasoning (Creswell & Creswell, 2017). My role in this study was to examine teachers' perceptions of assessment data usage and instructional strategies used in mathematics at the middle school level. Additionally, my role as the researcher involved developing and implementing interview protocol, data collection, and analysis. I was impartial, methodical, ethical, and reflective throughout this examination (see Merriam & Tisdell, 2016; Yin, 2016). I disseminated findings from interviews to inform readers of emerging themes based on the participants' perceptions.

For over 15 years, I have been employed as a secondary science teacher. However, I did not include participants who work at my school. Instead, participants were recruited nationally. Therefore, I foresaw no immediate ethical conflicts in this study because I had no supervisory authority over the participants. Furthermore, I developed an interview protocol to mitigate innate biases.

There is potential for bias in all research. Underlying assumptions and beliefs may affect my decisions as a qualitative researcher (Ravitch & Carl, 2016). Therefore, it is

critical for the qualitative researcher to confront innate beliefs from an ethical position. I understand that my own beliefs and experiences may contribute to bias. As such, I collaborated with members of my doctoral committee to determine research methods that would not impose bias (see Ravitch & Carl, 2016). Seeking the expertise of advanced researchers was pivotal throughout my research process. This interaction led me to examine my role as a researcher and various vectors of the research process that would have otherwise been unexamined (see Ravitch & Carl, 2016). Biases were further managed through the subject matter expert checks that were conducted to ensure the validity of the interview protocol (Zamanzadeh et al., 2015). Their revisions, in addition to those of my committee, facilitated the refinement of the interview protocol to ensure their alignment with the RQs and mitigated potential bias.

Methodology

Participant Selection

I drew a criterion sample of middle school mathematics teachers to select study participants. The use of this sampling strategy limited recruitment and generalizability to that of only middle school mathematics teachers. Criterion sampling is based on how participants self-identify (Ravitch & Carl, 2016). For this study, the sample criterion was based on certification status and subject area. Participant diversity contributes to the richness and complexity of the collected data (Ravitch & Carl, 2016). Therefore, for this study, I considered the perceptions of teachers with various years of experience in the field. This sampling strategy ensures that generalizations concerning the target population

could also apply to the mathematics teachers' total population in various school districts. Other content area teachers were not invited to participate.

Instrumentation

Information regarding participants' perceptions is necessary to acquire insight into the study problem. Therefore, I conducted individual interviews (see Yin, 2016). I developed an interview protocol in alignment with the study's RQs (see alignment table in Appendix A). The interview protocol features 14 open-ended questions that I asked to understand how middle school mathematics teachers perceive and understand assessment data usage and instructional strategies (see Appendix B). The interview protocol was vetted by an expert panel consisting of my doctoral committee members and three subject matter experts, each holding doctoral degrees in the field of education. This critical step was completed before engaging the participants to ensure content validity (see Zamanzadeh et al., 2015). Seeking feedback from other professionals in my field was helpful for refinement purposes. This feedback allowed me to determine what is unclear or confusing for potential participants (see Zamanzadeh et al., 2015). This insight was useful for enhancing the protocol's clarity and promoting trustworthiness. Moreover, useful and pertinent information can be obtained from the usage of follow-up probes (Merriam & Tisdell, 2016). Therefore, I asked questions as needed to develop my understanding further using a nondirective and conversational tone (see Yin, 2016).

I used the following data collection instruments: an interview protocol, live Microsoft Teams recordings, and field notes. The interviews were audio recorded to ensure that data were collected verbatim (see Patton, 2015). I also transcribed the audio

recordings. I authored the interview protocol in direct alignment with the study's purpose. Moreover, I kept field notes to record observations, newly emergent themes, participant gestures, or potential causes for bias (see Creswell, 2013; Merriam & Tisdell, 2016). Additionally, these field notes may include my reactions and interpretations of the collected data (see Patton, 2015). Data verification and review followed each completed interview, and I documented this process in my field notes (see Yin, 2016). Additionally, these field notes were another data point to enhance credibility (see Yin, 2014).

As the researcher, I was responsible for ascertaining each participant's perceptions and understandings. Methodically and transparently adhering to the evidence helped to build credibility (Yin, 2016). Before implementing the interview protocol, I collaborated with an expert panel consisting of my doctoral committee members and three subject matter experts, each holding doctoral degrees in the field of education. Engaging in this process can help a researcher recognize potential bias embedded within the questions and RQ misalignment (Yin, 2016). No major discrepancies were identified.

Procedures for Recruitment, Participation, and Data Collection

With approval from the Walden University Institutional Review Board (IRB; approval no. 05-26-21-0743802), I sent electronic mail invitations to potential participants via the Walden University participant pool and various social media platforms. Additionally, snowball sampling was used to muster participation. Those agreeing to participate replied, "I consent." Upon receipt of the participants' informed consent, I scheduled the interview time and dates according to participant availability. I aimed to obtain eight to 12 consenting participants for this study (see Groenewald, 2004;

Guest et al., 2006; van Manen, 1990). This sample size should be sufficient because qualitative studies focus on obtaining in-depth understandings based on multiple viewpoints instead of generalizing (Ravitch & Carl, 2016). Equally important, recruitment and data collection proceeded in parallel, and I stopped recruiting participants once data saturation was achieved. Data saturation is achieved once the interviews yield no further information or themes (Guest et al., 2006).

In qualitative research, the researcher is chiefly responsible for data collection and analysis (Merriam, 2009). I tailored the interview protocol to the study purpose and used the interview protocol to probe information used for descriptive purposes. Moreover, I conducted interviews in a structured yet personal manner allowing for the opportunity to engage in follow-up questioning (Rubin & Rubin, 2012). On average, the interviews lasted 1 full hour. I conducted the interviews remotely via Microsoft Teams using a semistructured questioning approach. This approach allows the researcher to ask probing follow-up questions (see Merriam, 2009). With each participant's permission, I recorded and transcribed each interview. Recording the interviews allowed me to pick up on patterns and inflection that went unnoticed during the interview process (see Patton, 2015).

Furthermore, I designed the interview protocol (see Appendix B) to be open-ended, which allowed the participants autonomy in response. Open-ended questioning in the interview process helps minimize researcher bias while also helping the interview to flow like a conversation (see Rubin & Rubin, 2012). The qualitative researcher recognizes that their own potential biases may influence the research process (Ravitch &

Carl, 2016). Therefore, the researcher should continually assess the degree of that influence to reduce any potential impact on data collection and analysis. Moreover, maintaining field notes as I engaged in data analysis helped me to maintain neutrality through the assessment of my performance as a researcher (see Phillippi & Lauderdale, 2018). Conducting interviews allowed me to synthesize a narrative based on the understandings and perceptions of the study participants. Assessing these understandings and perceptions enabled me to find commonalities and contrasts.

Data Analysis Plan

I used a qualitative approach to analyze the interview data (see Glesne, 2016). I also used a typological approach to data analysis. A typology is a related set of ideals that can be used to interpret social constructs (Blaikie, 2018). A typology can be constructed to justify commonalities and discrepant data trends and generates descriptions among data points (Blaikie, 2018). To further analyze interview transcripts, I used open and axial coding to identify dominant emergent themes while adhering to the conceptual framework. This type of coding process is an inductive approach to chunking data into larger categorical abstract themes (Creswell, 2013). I further fragmented data by establishing patterns and assigning a specific code per theme or category (see Yin, 2016). This initial development of categorical themes is called open coding (Merriam & Tisdell, 2016). Then, I reassembled the data into broader categories using axial coding (see Yin, 2016). These codes and themes can further be used to demonstrate comparisons and contrasts between participant responses (see Resnick, 1979). Additionally, data analysis of the interview transcripts followed an inductive approach by selectively coding for

factors related to how, when, and why teachers collected student assessment data (see Ravitch & Riggan, 2016). This approach helped to establish a consensus of perceptions obtained from participants that were used to develop overarching categorical themes. Moreover, the axial coding process involved stringent comparisons and modifications of the initial codes into more cohesive groupings.

I further examined the categories to develop overarching themes. These overarching themes were based on repeated patterns among all data points (Patton, 2015). In searching for these overarching themes, I exercised caution to avoid bias during the data reassembly phase by comparing data sources using alternative explanations and looking out for discrepant trends (see Yin, 2016). Equally important, as a qualitative researcher, I maintained field notes that aided me in my data analysis reflections. Likewise, reflecting on and assessing my performance as a qualitative researcher is critical. Maintaining field notes or journals encourages the researcher's cognizance of performance and potential innate biases (Phillippi & Lauderdale, 2018).

Trustworthiness

Evidence of Data Quality

To further ensure data quality, I allowed each participant to review their responses and check for a cause to amend the transcripts, referred to as transcript review (see Glesne, 2016; Yin, 2016). This data quality check process allowed study participants to clarify, elaborate, or rectify information obtained during data collection. To further explore the credibility and validation of results, I provided the participants a chance to conduct a member check by providing a summary of the study's overall findings to

ensure accuracy (see Crossman, 2019). I conducted member checking interviews via Microsoft Teams with a sample of the participants. During those interviews, I discussed the study's overall findings (see Merriam, 2009). Member checking allows the study participants to validate the study's findings (Crossman, 2019). In contrast, a transcript review ensures that study participants can verify or amend their input before data analysis (Yin, 2016).

Procedure for Discrepant Data

Creswell and Creswell (2017) defined discrepant cases as data that are not aligned with emergent themes. Discussing inconsistencies within the data is an essential hallmark of credible research (Patton, 2015). I reviewed any cases that were out of alignment with the established themes. By identifying possible points of miscommunication or misinterpretation of questioning during interview protocols, I may identify if participant confusion may have contributed to the categorical outlier.

Ethical Procedures

In essence, the researcher must be committed to fostering a trusting environment for the participants by demonstrating transparency. Protecting participants from the potential inherent risk of harm is paramount. The IRB policies were in place to ensure those study participants were protected from harm. Therefore, no research was conducted without IRB approval (approval no. 05-26-21-0743802). This step promotes ethical and federal compliance. In addition to adhering to the IRB guidelines, I also completed ethics training courses offered by the Collaborative Institutional Training Initiative. In efforts to

moderate potential risks, appropriate measures were taken in consideration of confidentiality and informed consent.

Participant privacy is paramount to ethical research. Therefore, all participants were assigned a code for confidentiality. The safety and confidentiality of each participant are the duty of the researcher. All information obtained through the data collection process was not obtained or shared without consent. Additionally, I safely and securely stored all information related to the participants.

Participant inclusion in this project study required obtaining permission in advance of the study (see Creswell, 2012). Therefore, each participant's informed consent was obtained in advance of data collection and interview protocol. To promote transparency, I discussed interview protocols with participants before questioning. All potential participants were informed of the nature of the study and any potential for harm as a result of participation (see Yin, 2016). Furthermore, I made certain that each participant was conscious of their right to withdraw from the study without consequence.

Summary

Chapter 3 consisted of the research design, methodology, and data analysis plan. Additionally, I described how I used a qualitative approach to the research problem. Next, I explained how the participants were recruited and the participant criteria. Then, I provided the data collection methods, data analysis plan, and discussions regarding trustworthiness and ethical procedures. Chapter 4 includes the results obtained from the semistructured interviews.

Chapter 4: Results

The purpose of this qualitative study was to investigate middle school teachers' perceptions of assessment data usage and instructional strategies in mathematics. The RQs for this study were

RQ1: What are middle school mathematics teachers' perceptions of assessment data usage?

RQ2: How do middle school mathematics teachers choose personalized instructional strategies based on students' assessment data?

I used semistructured interviews to collect data from eight middle school mathematics teachers. In this chapter, I describe the setting for the study, provide participant demographics, and discuss the data collection and analysis processes. Additionally, I present evidence of trustworthiness and the results of my study.

Setting

Based on the criteria for the study, I gathered data from a total of eight participants. To recruit participants, I used the Walden University participant pool, placed relevant hashtags on social media posts to increase the prospect for engagement, and engaged in snowball sampling. Participants provided their consent via email response. Interviews were conducted based on the participants' availability. These semistructured interviews were conducted using Microsoft Teams videoconferencing app. The recruitment and interview processes were conducted over a period of 6 weeks.

Demographics

For this study, I required that all participants be a minimum of 18 years of age, have experience in teaching mathematics at the middle school level, and hold a current teaching certificate. I interviewed a total of eight participants for this study. The participants' years of experience ranged from 5 to 18. The mathematics teachers who participated taught in various public schools across the United States. At the time of this study, five participants served (or had previously served) in instructional leadership positions, and two served as members of the school improvement committee.

Data Collection

Each participant completed one initial interview using the Microsoft Teams videoconferencing app. The interviews ranged from 57 minutes to 1 hour and 15 minutes, and the mean interview length was 60 minutes. The interview duration may have varied based on some participants' experience in leadership roles. A leadership role would have widened their scope of knowledge and allowed them to respond more fully to some questions.

I used the embedded Teams features to record audio and video of each interview. Teams autogenerated a closed-caption text file I used to create each interview transcript. Then, I copied each text file into separate Microsoft Word documents for further manual editing. I edited all interviews to ensure a verbatim report of each interview recording.

Data Analysis

I organized the interview data to identify commonalities among participants' responses. This process involved manual transcript coding using the simple markup

feature in Microsoft Word to add comments within the transcript to highlight initial open codes throughout each documented transcript. This method helped me to generate a useful typology of initial codes that emerged into broader categories pertaining to how, when, and why teachers collected student data. I made stringent comparisons of codes into cohesive groups. This axial coding process led to the identification of overarching themes based on repeating patterns. Data saturation was achieved once I realized that the data yielded no further insight.

Before the coding process started, I developed seven a priori codes. From these codes emerged 31 broader, axial codes. Using inductive reasoning, I carefully revisited each interview transcript document to develop a consensus of participants' perceptions, and I was able to group the data into 16 categories. After assigning codes per category, I identified a total of six more dominant emergent themes. Tables 1 and 2, respectively, show the alignment of codes to themes and the alignment of themes to RQs. Table 1 displays groups of codes and emergent themes.

Table 1

Alignment of Codes to Themes

Code	Theme
Using assessment results, time constraints (affecting data analysis), frequency of assessment, continuous diagnostic assessment, feelings towards using and analyzing data, low growth attributed to attendance issues or apathy	Teachers perceive that they do not have enough time to analyze data results due to repetitious testing schedules.
Instructional support, involving parents as partners, collaboration	Teachers realize that stakeholder input enhances classroom success.
Awareness of assessment data, reflection, kinesthetic learning, self-paced learning, project-based, vocabulary emphasis/writing prompts, instructional strategies, backwards planning, real-world application, evidence-based, interactive, technological application, providing feedback to the student	Teachers use varied instructional strategies.
Measuring effectiveness, using data to measure teacher efficacy, effectiveness measured by student enjoyment, effectiveness measured by student engagement, understanding data, remediation, personalization, precision	Teachers use data as a metric for improvement, but teachers' determinant percentage for remediation appears to vary.
Fidelity, autonomy, personal learning, establishing an environment conducive to learning	Teachers implement their instructional duties with fidelity, but some describe a diminishing sense of autonomy related to instructional and assessment decisions at the school level.
Surveying student opinion, student/peer evaluations, using data to understand	Teachers use data to understand their students better; however, some teachers are concerned with whether

student, motivated by student engagement, low growth attributed to attendance issues or apathy	students can translate data into meaningful practice.

I examined two research questions, and six themes emerged. Theme 1 encompasses teachers' perception that they do not have enough time to analyze data results due to repetitious testing schedules. Theme 2 shows teachers' realization that stakeholder input enhances classroom success. Theme 3 reveals that teachers use varied instructional strategies. Theme 4 pertains to the realization that teachers use data as a metric for improvement, but teachers' determinant percentage for remediation appears to vary. Theme 5 reveals that teachers implement their instructional duties with fidelity, though some described a diminishing sense of autonomy related to instructional and assessment decisions at the school level. Theme 6 suggests that teachers are concerned with whether students can translate assessment data into meaningful practice. Table 2 displays the alignment between emergent data themes and the RQs for this study.

Table 2

Alignment of Themes to Research Questions

Theme	Research question
Theme 1: Not Enough Time to Analyze Data Results Due to Repetitious Testing Schedules. Theme 2: Realization That Stakeholder Input Enhances Classroom Success	RQ1: What are middle school mathematics teachers' perceptions of assessment data usage?
Theme 3: Use of Varied Instructional Strategies Theme 4: Use of Data to Support Personalized Instruction Theme 5: Implementation of Instructional Duties With Fidelity Theme 6: Use of Data to Better Understand Students	RQ2: How do middle school mathematics teachers choose personalized instructional strategies based on students' assessment data?

Results

I examined two RQs in this basic qualitative study. In this section, I report the results of the study as framed by the RQs. Fullan et al.'s (2006) three Ps model informed the results. I included excerpts from participants' responses to support the study's findings.

Research Question 1

The first RQ addressed the participating mathematics teachers' perceptions of assessment data usage. I used the interview protocol to elicit information about middle school mathematics teachers' perceptions of assessment data usage. I grouped six codes

from the data to create a category from which the first theme was developed. There were two themes associated with the first RQ. Next, I discuss the emergent data patterns with supporting evidence per theme.

Theme 1: Not Enough Time to Analyze Data Results Due to Repetitious Testing Schedules

Theme 1 resulted from a compilation of understandings pertaining to teachers' perceptions of assessment data usage. Having available time was a critical factor for teachers when collaboratively planning and analyzing assessment results. All teachers reported the various ways in which they used assessment results in their classrooms. Each teacher reported using assessment results to activate, remediate, and supplement student learning. For example, Participant 1 stated, "If students do not pass their assessments, teachers will do small group instruction targeting areas of improvement for students." Likewise, Participant 2 discussed using online instructional games in the classroom, "[Using online instructional games] helps me to see what students know on their own…it assists [students] in reviewing and discussing the correct solution." Similarly, Participant 6 shared, "I use daily essential questions and learning goals outcomes to ensure that we have daily goals to master. I allow reteaching and remediation to ensure mastery of content." Along the lines of the same pattern, Participant 5, who self-identified as a "data fanatic", discussed using technology for assessment data analysis:

> I use the data to identify skills needed for review and customize openings for each class period based on that data. I also provide my students with individualized learning plans which serve the purpose of closing gaps in learning…I use the help

> of technology to keep a continuous diagnostic of their current levels, which, in turn, updates their learning plan, which they work on two to three times a week in addition to our core content.

In contrast, although all teachers reported that they gathered assessment data for instructional purposes, multiple teachers reported that periods between assessments are not lengthy enough to allocate time towards assessment data analysis. Participant 2 explained, “We don’t discuss common assessments results because of the frequency of them.” Moreover, a related pattern emerged as the teachers’ responses revealed a preference towards shorter, informal assessment practices that better fit their content pacing schedules. For example, Participant 3 stated, “I believe the daily, quick, formative assessments…do not have to take a long time to be written and…[are] efficient in determining understanding.” Participant 3 further emphasized, “Formative assessments can be given whenever a teacher needs to determine comprehension before moving onto another topic…but [with] summative assessments…students do not have a chance to redo.” On another note, a different pattern emerged as one of the teachers discussed how time restraints may contribute to lagging student performance when trying to remediate instruction for absentee and ELL students. Specifically, Participant 8 explained, “[The] students may be two to three grade levels behind…continuously digging a hole as the year progresses and never fully mastering the previous standards…students move on to the next grade with teachers trying to differentiate.”

Overall, the participants all reported their usage of assessment to inform instruction. Teachers provided insight pertaining to how they use technology to facilitate

the assessment process. However, some teachers reported that frequent testing cycles posed time restraints on assessment data analysis. Responses indicated that these time restraints contribute to gaps of knowledge among some students.

Theme 2: Realization That Stakeholder Input Enhances Classroom Success

Theme 2 was derived from a separate set of codes related to teachers' perceptions of assessment data usage. Teachers shared that the leadership in their schools supports them through the facilitation of professional development and content collaboration meetings. This support enabled teachers to obtain valuable input from their peers and other stakeholders. For instance, Participant 2 stated, "We like to…compare results, discuss common misconceptions, and share resources for remediation." Furthermore, the data revealed that teachers regularly met with other teachers to develop, plan, and evaluate the effectiveness of common assessments. Participant 2 further elaborated, "Well, we meet with the team weekly. Wednesdays are designated days for professional development and content planning." Likewise, Participant 5 explained, "Planning [assessments] is done in collaboration with the mathematics department and county, as well." A pattern involving collaborative stakeholder efforts was also demonstrated when Participant 7 remarked, "Well, my grade level meets every Wednesday to discuss sixth grade content." In like manner, Participant 3 spoke about the school improvement meetings, stating:

> These meetings are comprised of administration, other school leaders, and department chairs. Additionally, once a month, all content teachers meet for their department meetings where vertical planning and data analysis takes place.

> Department chairs lead those meetings and bring thoughts, questions, [and] ideas from those meetings to the School Improvement Team meetings on the last Wednesday of each month.

Furthermore, when I questioned Participant 3 regarding forms of student data used to inform instruction, the response was, "data…information from my team teachers, student portfolios and reflections, student surveys, et cetera." Additionally, one of the teachers shared their successes with communicating data results to parents and students as stakeholders in the education process. Specifically, Participant 5 explained assessment data usage in the classroom stating, "I use data to create a plan for personalized progress for each of my students…I share the data with my peers, parents, and the students to communicate their progress." In fact, many teachers reported that assistive technology helps them be more intentional when planning instruction. For example, Participant 5 said, "In my classroom, I love using assistive technology and programs that assist me in quickly monitoring the progress of my students…It also provides my students with a continuous diagnostic…and areas in need of support."

Moreover, a variant pattern emerged as another teacher mentioned a varied approach that involved students as active members in the evaluation process. According to Participant 4, incorporating student input in assessing and evaluating a learned skill enhances learning outcomes. Participant 4 added, "My students love test analysis days. I think they'd rather find their own errors and work at their own pace rather than me standing in front and telling them what to write." By the same token, it was further revealed that some teachers use student survey input to guide instructional decisions.

Participant 3 proclaimed, “I also conduct student surveys to gauge how my students felt about a particular assignment or project, for example.”

Overall, the participants shared information about how they are making efforts to collaborate with stakeholders at the school level. Reports indicate that teachers are using technology to communicate assessment data to student and parent stakeholders. However, only some teachers reported actively involving their students in the evaluation and instructional planning processes.

Research Question 2

The second RQ addressed how mathematics teachers choose personalized instructional strategies based on students’ assessment data. Through data analysis, code-based patterns emerged that contributed to the following four themes. Next, I describe emergent data patterns using evidence from participants’ interviews as support per theme discussed.

Theme 3: Use of Varied Instructional Strategies

Theme 3 emerged as teachers reported information on selecting personalized instructional strategies based on students’ assessment data. All teachers reported using formal and informal instructional and assessment practices to develop student profiles. For instance, Participant 6 explained, “Because all students do not learn or master content in the same manner, so it is important that I utilize various strategies to reach all of my students.” The same pattern was demonstrated in the remarks of Participant 5: “Students are moving away from long lectures and note taking and instead are participating in more engaging learning activities, performance tasks, projects…They also take county

benchmarks, short quizzes, participate in discussions, writing prompts, and compete in educational gaming." When asked whether these varied strategies have proven to be effective, Participant 3 asserted:

> Yes, I do. When you use best practices in your classroom combined with analyzing data and a caring attitude towards your students, great things happen in the classroom. Not all students learn the same way, so it is important to offer students many ways to learn and show what they know.

Some of the most mentioned instructional strategies were backwards planning, project-based learning, student reflection via peer review, incorporating writing prompts with an emphasis on content-based vocabulary, and creating assignments that include technological and real-world applications. Furthermore, both Participant 3 and Participant 5 shared the same opinion on the topics of emphasizing content-based vocabulary and writing prompts in mathematics. Specifically, Participant 3 found, "When checking for comprehension of a concept, I find that requiring students to explain their learning, usually through constructed response questions or some type of writing within a real-world situation, determines whether they [students] truly understand the concept."

A new pattern was revealed as a portion of teachers also shared that they are differentiating instruction based on student interest, while most reported that they differentiate instruction according to student ability or current research trends. For example, Participant 8 explained, "It depends on my audience. I have to decide what works or does not work because all classes and students are different. You just have to

feel out how your classes respond on your delivery of instructional material." Likewise, Participant 3 stated the following:

> Many factors determine which instructional strategies to employ. Such as, the capabilities of the students within a class, the learning styles of the students, how much time we have, student surveys, what has worked well with a particular group of students…student needs, et cetera.

Along the lines of the same pattern, Participant 4 discussed, "I base it [differentiation] off the class, their learning levels, and types. I also consider the time that we have in class and the end goal that I'm trying to accomplish." In contrast, Participant 2 differentiated mostly based on current research trends. The respondent noted, "I like to use instructional strategies that research has shown to be highly effective…for students." Participant 2 further elaborated on instructional and assessment practices, "I research…to assist with instructional and assessment practices at the school. As for myself, I am a data fanatic."

Ultimately, the teachers provided insight into how they vary instructional strategies and provided justification based on varied perspectives. Reports revealed that teachers are differentiating instruction. Some teachers differentiate solely according to test results and research trends, and others reported using student interest level in an activity to guide their instructional decisions.

Theme 4: Use of Data to Support Personalized Instruction

Theme 4 resulted from a collection of understandings about how mathematics teachers choose personalized instructional strategies. The data indicated that teachers are efficacious in collecting data as a determining factor for remediation. Participant 1

commented, “The program we use…provides easy to understand data records for teachers to support students in struggling content areas.” Similarly, Participant 3 shared

> Assessment data was a very important part of my teaching. After every assessment, I would look for the questions that the majority of my students answered incorrectly…For those answered incorrectly by the majority, I would use those same questions in opening starters for the day. I would also make notes in my unit plans…for new ways to teach the topic and new strategies.

In fact, many teachers reported using student performance data to measure their effectiveness of instructional delivery. For instance, when asked about assessment data usage in the classroom, Participant 1 posited:

> Well, A: Check for understandings. For example, during class lessons to see if I need to review material or change the way I am teaching it. B: Exit tickets, like, done daily to determine if students understood the lesson objective. This will also inform me of who I need to group together for small group instruction…D: Summative assessments, which typically are done like small group instruction, are for review or spiraling throughout future lesson.

Likewise, Participant 5 said, “I use data to create a plan for personalized progress for each of my students. I also use the data to plan for future lessons and tutorials…I also use the data to evaluate my effectiveness as an educator.” Furthermore, a few teachers shared that they measure their effectiveness based on student engagement and the extent to which students enjoyed the lesson. For instance, Participant 5 elaborated on the employment of instructional strategies, “I decide which strategies to use based on the

level of student engagement and pre assessment results." Likewise, Participant 7 in a similar pattern commented, "I consider the lesson to be effective if majority of the class is answering the questions accurately and each student is involved."

However, each teacher's response varied when asked to provide a scale for determining what percentage of students would need to fail a task before implementing remediation. These are the responses per participant. Participant 1 reported, "At my school, we use the 70% as a cut off as it aligns to standard based grading. So, any students who falls below that 70% would be a candidate for an intervention for that skill." Participant 2 reasoned

> I would say, if about 50% or more aren't getting it, then it would require reteaching or a different strategy. Anything less than that, it could be just a common misconception that's easier to clear up with reviewing a problem or two as a class for an opening.

Likewise, Participant 8 also found, "If I get more than, say, 50% not doing well, that is when I still reteach the whole class." Moreover, a different pattern emerged as other teachers proposed lower determinant percentages for remediation, as illustrated in the responses from Participant 3, Participant 5, and Participant 6. Specifically, Participant 3 considered, "I figure if about 40% or more of the students miss a question—definitely time to regroup." Along the same lines, Participant 5 asserted, "If more than 30% fail, we do a quick review, and I invite students to tutorial. If under 30%, I reveal solutions and invite students to tutorials." The narrowest of determinant percentages for remediation

was observed in the comments of Participant 6, who shared, “After testing, I will remediate students individually if less than 90% have mastered the concepts.”

At any rate, all teachers reported using student assessment data to assist with the provision of personalized instruction. Moreover, all teachers are remediating instruction for struggling students. Equally important, all teachers use a district-approved grading scale. There was not a consistent determinant percentage for implementing remediation.

Theme 5: Implementation of Instructional Duties With Fidelity

Theme 5 was based on how teachers use student assessment data when making choices regarding instructional strategies. When I asked teachers about their level of involvement in evaluating instructional and assessment practices at their schools, their responses varied. For example, Participant 7 commented, “I have little involvement.” Similarly, Participant 2 answered, “I have some involvement…but not at the school level. At the school level, we rarely evaluate instructional and assessment practices.” Teachers serving as department chairs or school improvement committee members reported higher levels of involvement related to instructional and assessment decisions at the school level. For instance, Participant 3 explained, “I have quite a bit of involvement in the evaluation of instructional and assessment practices at our school. I am writer of the CSIP [Continuous School Improvement Plan] …we discuss assessment data…implementation of strategies, et cetera.” Most teachers shared that they follow a rigorous assessment schedule that includes both state mandated assessments and daily teacher-authored assessments. I inquired into the frequency of assessments so as to confirm the extent of rigor posed by the assessment schedules and fidelity of implementation. For example,

Participant 2 shared, “Students complete individual assessments, like the Quizizz [assessment platform], every other week…they have a quiz maybe one to two times per unit, and a summative test one per unit—which is, like, every 4 to 6 weeks.” Participant 2 further elaborated on how the use of daily learning targets helps to determine instructional activity effectiveness leading up to the summative assessments. Specifically, the respondent added, “I do not think students have to meet the learning target within 1 day, but they know they have met a learning target based upon their scores for the assessment—formative or summative.” Likewise, Participant 4 pointed out, “The learning target and success criteria helps both students and I stay on track with what they should be mastering…The success criteria [data] will oftentimes lead me to the formative assessments for that day.” The remarks of Participant 1 also followed the same pattern pertaining to assessing students daily. The respondent explained, “Well…exit tickets, like, done daily to determine if students understood the learning objectives. This will also inform me of who I need to group together for small group instruction.”

Although teachers reported what could be perceived as a rigorous testing schedule, teachers also recognized that consistent assessment data collection and data analysis facilitated the precision of their instruction. Specifically, Participant 6 mentioned, “I think that data is an essential part of teaching and learning so collecting and analyzing is essential reteaching, enrichment, and differentiation of content and delivery.” Similarly, Participant 3 pointed out, “When you use best practices in your classroom combined with analyzing [assessment] data and a caring attitude towards your students, great things happen in the classroom.”

A discrepant case was established when a teacher asserted that mandated standardized test content and testing schedule contributed to the disenfranchisement of ELL students. This teacher also shared that more could be gauged from students when they engage in shorter, teacher-authored assessments. More specifically, Participant 8 commented, “In all honesty, my daily informal observations and daily assignments give me a better idea if they are learning the material.” Furthermore, the respondent expressed that mandated assessments do not culturally align with the student body compared to teacher-authored assessments. Participant 8 further explained, “I think the leveling of how the assessments are created do affect mastery from my [ELL] students…So, basically the student is continuously digging a bigger hole…and never fully mastering the previous standards.”

Ultimately, teachers reported varying opinions regarding their level of input and autonomy regarding assessment practices. Some teachers shared that they could better serve their students if they had more control over assessment practices. Only those teachers in leadership positions shared that they have a role in the decision-making process for assessment practices at the school level.

Theme 6: Use of Data to Better Understand Students

Many teachers revealed that they involve their students in the assessment process by allowing students to evaluate their peers. For instance, Participant 3 said, “[I] analyze data to see strengths and weaknesses to drive instruction…and we also use peer sharing, peer evaluation…for diagnostics and practice.” Along the same lines, Participant 7

explained how assessment data are assistive when grouping students. The respondent elaborated:

> I know some students need extra help, so I place them with a student who would be able and willing to assist them in the activity…One student should be slightly higher, but not too much. I also place students together as partners if they might need language assistance, and they speak the same home language.

Furthermore, a few teachers reported that they conducted surveys of their students' opinions regarding classroom instructional and assessment practices yielding positive results. Particularly, when asked about using forms of data to develop student profiles, Participant 5 pointed out, "I also use…results from their [students'] continuous diagnostic, learning style surveys, student surveys…et cetera." The respondent further explained:

> Yes, customizing, individualizing instruction to fit the needs of the students has proven to be effective. I can say this based on the evidence of student growth…I have my students work on their customized learning plans at least twice weekly.

A different category emerged when some teachers shared that their students were indifferent to knowing their assessment results. Participant 5 stated, "For example, while I teach many low performing students…of the low growth population, many [were] students with attendance issues or who refuse to participate." Similarly, Participant 2 discussed making students members of the evaluative process. The respondent explained, "I also use assessment data as talking points with students for them to see their individual growth and their growth as a class." However, when I asked the respondent to discuss

how students responded to being a part of their own performance evaluation process, the respondent laughed and remarked, “Well, the responses vary because some students enjoy knowing their data and seeing what they need to work on—I can tell by their follow-up questions. Other students act like they don’t care and just take in the information.” In efforts to combat student apathy towards assessment data, one teacher shared a success story involving merging students into the evaluative process by providing them with point-based incentives for participation. Specifically, Participant 4 stated, “After classroom assessments, my students complete a test analysis…I give them half credit back for each question that they correct.” The respondent further explained:

> I do believe that they [strategies] are effective because I believe in students learning not only from their mistakes but also from independently correcting them. I believe that it has a positive impact on their learning and gives them more motivation to find their errors.

Overall, some teachers had success with students translating assessment data into meaningful practice. It was reported that incentives, such as extra course credits, boost student participation in evaluating assessment data. Some teachers in the study noticed apathy among students pertaining to evaluating assessment data for growth purposes.

Evidence of Trustworthiness

Trustworthiness is essential to a qualitative study (Ravitch & Carl, 2016). To increase confidence in the accuracy of the data reported, I adhered to the standard criteria for ensuring credibility and trustworthiness, as investigated by Lincoln and Guba (1985).

To develop trustworthiness, I adhered to the following criteria: credibility, transferability, dependability, and confirmability.

Credibility

I employed member checking to establish data credibility (see Ravitch & Carl, 2016). First, I sent each participant a summary of the study's findings via electronic mail. Second, I conducted post data analysis discussions with several participants for member checking, allowing participants to discuss the study's findings, and these participants did not offer any suggestions for revisions. Third, I maintained field notes to record my observations and emergent themes and document my interpretations of the data. Moreover, the field notes were another data point to enhance credibility (see Yin, 2014).

Transferability

To increase the transferability of the study's findings, I provided detailed descriptions of the data so that the results may be applicable to other settings (see Merriam, 2009). I interpreted and described emergent data trends while providing supporting evidence obtained from participants' interview excerpts. I provided detailed data descriptions that may be useful to another researcher's study.

Dependability

Dependability refers to the fidelity of the data when applied to similar conditions (Polit & Beck, 2012). To establish dependability, I thoroughly described my research methods and the study results (see Merriam & Tisdell, 2016). Providing clear descriptions of methods and results obtained enables other researchers to replicate this study with similar conditions and participants. Additionally, I had concurrent discussions

with my doctoral committee chair throughout each stage of the research process (see Ravitch & Carl, 2016). My study was dependable because of these measures.

Confirmability

Confirmability was addressed by using verbatim reports of participants' interview responses to justify data interpretations. I used Microsoft Teams videoconferencing app to generate a closed-caption text file transcript of each recorded interview. Then, I transferred the transcripts to Microsoft Word for editing. My interpretations and findings were precisely derived from the data. I conducted data analysis of participants' interview transcripts by comparing participants' interview excerpts to my field notes. These field notes contained my reactions and interpretations of the collected data.

Summary

In Chapter 4, I reported the results of my basic qualitative study. This study highlighted the perceptions of middle grades mathematics teachers pertaining to assessment data usage and instructional strategies. The mathematics teachers who participated taught in various public schools across the United States. At the time of this study, five participants served (or had previously served) in instructional leadership positions, and two participants served as members of the school improvement committee.

Data collection was conducted via individual interviews on the Microsoft Teams videoconferencing app. I used open-ended questioning techniques to solicit the responses of the participants. All interviews were transcribed using the auto-generated closed captioning feature on the Microsoft Teams videoconferencing app and later edited

verbatim using Microsoft Word. Additionally, I maintained field notes throughout the course of data collection and analysis.

I organized the interview data and identified commonalities among participants' responses. I manually coded the transcripts highlighting initial open codes throughout each documented transcript. As a result of this method, I generated a useful typology of initial codes that emerged into broader categories that became cohesive groups that were formed by rigorous comparative analysis. This axial coding process led to overarching themes based on repeating patterns. I described the trustworthiness of my study through my discussion of how the study demonstrated credibility, transferability, dependability, and confirmability.

I sought to answer two RQs. The first research question addressed the mathematics teachers' perceptions of assessment data usage. Two themes emerged for RQ1. Participants shared in Theme 1 how they used assessment results as a diagnostic for instruction, but some teachers expressed how time constraints due to repetitious testing schedules affect data analysis. It was also reported that these time constraints have contributed to the perpetuation of achievement gaps among low performing students because teachers do not have time to address the deficits wholly. In Theme 2, participants shared how stakeholder input from parents and students had yielded positive assessment results. Some participants, however, reported apathy among students.

The second RQ addressed how mathematics teachers choose personalized instructional strategies based on students' assessment data. Four additional themes emerged for this question. In Theme 3, it was reported that teachers use varied

instructional strategies. There was similarity between teachers when comparing assessment and instructional strategies, yet only a few discussed how they incorporate writing and vocabulary emphasis into their mathematics courses. Theme 4 revealed that teachers use data as a metric for improvement, but teachers' scale to determine a cause for remediation varies. Each participant stated a different determinant percentage for remediation. Theme 5 was teachers implement their instructional duties with fidelity, but some describe a diminishing sense of autonomy related to instructional and assessment decisions at the school level. Teachers that did not serve in leadership roles at their schools often conveyed that they did not contribute much to assessment decisions at the school level. Participants reported in Theme 6 that teachers use data to understand their students better, yet some teachers are concerned with whether students can translate data into meaningful practice. There was mixed feedback from participants regarding Theme 6. Most teachers explained how they have succeeded in getting students to participate in data talks about their performance, but student apathy remains an issue for other teachers.

In Chapter 5, I relate the study's findings to the literature review. I provide further related research on the topic and discuss the study's limitations. Last, I share the implications of the research and the study's potential for social change.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this qualitative study was to investigate middle school teachers' perceptions of assessment data usage and instructional strategies in mathematics. I conducted semistructured interviews to collect data from eight middle school mathematics teachers. Six themes emerged from data analysis. Theme 1 was developed from a set of codes that suggested that teachers perceive that they do not have enough time to analyze data results due to repetitious testing schedules. Theme 2 shows that teachers realized that stakeholder input enhances classroom success. Theme 3 reveals that teachers use varied instructional strategies. Theme 4 resulted from the realization that teachers use data as a metric for improvement, but teachers' determinant percentage for remediation appears to vary. Theme 5 reveals that teachers implement their instructional duties with fidelity, but some described a diminishing sense of autonomy related to instructional and assessment decisions at the school level. Theme 6 suggests that teachers are concerned with whether students can translate assessment data into meaningful practice. The remainder of this chapter includes a discussion of the study's findings, recommendations, and potential impact for social change.

Interpretation of the Findings

Next, I compare how the study's findings confirm, disconfirm, or extend knowledge in the discipline of education with the literature described in Chapter 2. I also analyze and interpret the findings in the context of the conceptual framework for this study, Fullan et al.'s (2006) three Ps model. Fullan et al. philosophized that precision, personalization, and professional learning (the three Ps), when fully developed, may lead

to changes in teachers' beliefs and understanding toward improving student learning. The core concepts of the three Ps model are based upon teachers providing precise and personalized instruction that is valid and data driven. This section is arranged according to RQ and related themes. I examine all six themes in correspondence to the literature and conceptual framework.

Research Question 1: What Are Middle School Mathematics Teachers' Perceptions of Assessment Data Usage?

The two themes aligned to RQ1 confirm and extend knowledge in addition to those studies mentioned in Chapter 2. Theme 1 encompasses teachers' perception that they do not have enough time to analyze data results due to repetitious testing schedules. The participants all reported their usage of assessment to inform instruction. Teachers in the study provided insight pertaining to how they use technology to facilitate the assessment process. However, some participants reported that frequent testing cycles posed time restraints on assessment data analysis. Responses indicated that these time restraints contribute to gaps of knowledge among some students. My findings confirmed those of three studies that suggested that assessments are more meaningful when timed appropriately, thusly allotting teachers the time to use assessment data to inform instructional practices (Agboola & Hiat, 2017; Dennis & Gratton-Fisher, 2020; Lee et al., 2020). Essentially, appropriately timed assessments lead to boosts in student achievement. Additionally, some researchers have reported that teachers use technology to ease the strain of frequent assessments (Beasley & Beck, 2017; Gokcearslan, 2017).

Their reports indicate that teachers' technology usage facilitates the diagnosis for remediation and enhances instructional practices.

Theme 1 aligns with Fullan et al.'s (2006) three Ps model, which entails making assessment data more manageable to provide precise instruction daily. Fullan et al. stated that teachers are primary stakeholders in the education community. Establishing a system that provides teachers with the required information to make well-informed decisions will result in continuous daily improvements in student learning outcomes.

Theme 2 centered on teachers' realization that stakeholder input enhances classroom success. The participants shared information about how they are making efforts to collaborate with stakeholders at the school level. The participants' responses indicated that participants communicated assessment data to student and parent stakeholders. However, only some teachers in the study reported actively involving their students in the evaluation and instructional planning processes. This theme is related to research conducted by Haymon and Wilson (2020), which revealed that classrooms that offer students a choice of assessment allot student autonomy. The results of this study also extended the findings of several studies that showed that this approach to assessment inspires student interest (Bernacki & Walkington, 2018; Haymon & Wilson, 2020; Reber et al., 2018).

These findings confirm Fullan et al.'s (2006) principle regarding personalization. The authors stated that engaging students results from cultivating learning experiences that match and inspire their needs. Establishing personalized systematic approaches for mathematics students remains a central topic of interest for many researchers and

stakeholders (Walkington & Bernacki, 2015, 2019). Moreover, these research findings provide answers for RQ1 because the information obtained from the participants provides insight into how teachers use assessment data to inform instruction. In this study, I examined teachers' perceptions of assessment data usage and instructional strategies. Evidence from the literature suggests that teachers struggle to use assessment data to inform daily instruction (Datnow et al., 2021). Additionally, the literature reveals that more information is needed about how teachers use assessment (Schildkamp, 2019). The themes developed in support of RQ1 further the understanding of the perceptions of mathematics teachers related to assessment data usage and the selection of instructional strategies. The participants' responses provided a detailed account of the phenomenon.

Research Question 2: How Do Middle School Mathematics Teachers Choose Personalized Instructional Strategies Based on Students' Assessment Data?

The remaining themes (Themes 3-6) relate to RQ2. These four themes further confirm and extend knowledge in the discipline in addition to those studies discussed in Chapter 2. Theme 3 concerns teachers' use of varied instructional strategies. The participants provided insight into how they vary instructional strategies and provided justification based on various perspectives. The participants' responses revealed that participants are differentiating instruction. Moreover, some participating teachers differentiated solely according to test results and research trends, and others reported using student interest levels in an activity to guide their instructional decisions. This theme confirms the research findings of several studies that emphasized differentiation as

a strategy to effectively scaffold instruction to assist students' learning endeavors (Brigandi et al., 2019; Gavin & Renzulli, 2021; Prast et al., 2018).

Additionally, Theme 3 aligns with the principles of the three Ps model (Fullan et al., 2006). Specifically, the principles of personalization and precision require the teacher to diagnose each student to determine starting points and interventions for instruction, which requires expertise. Studies have shown that mathematics differentiation continues to challenge teachers (Bardy et al., 2021; Russo et al., 2021). Furthermore, mathematics teachers have acknowledged the need for support in content differentiation (Kruse et al., 2017).

Theme 4 revealed that teachers use data as a metric for improvement, but teachers' determinant percentage for remediation appears to vary. Participants reported using student assessment data to assist with the provision of personalized instruction. Moreover, all teachers in the study indicated that they remediated instruction for struggling students. However, there was not a consistent determinant percentage for implementing remediation. The works of Jimerson et al. (2021) and Johnson et al. (2019) suggested that limited data literacy has reduced teacher agency. Furthermore, teachers' responsiveness to students' needs and remediation implementation tends to vary according to teachers' beliefs (Paek & Sumners, 2019; Tomlinson, 2017). These phenomena coincide with Fullan et al.'s (2006) three Ps model principle of professional learning. According to the three Ps model, professional learning should be ongoing, cohesive, and overarching.

Theme 5 revealed that teachers implemented their instructional duties with fidelity, but some described a diminishing sense of autonomy related to instructional and assessment decisions at the school level. Teachers reported varying opinions regarding their level of input and autonomy regarding assessment practices. Some teachers shared that they could better serve their students if they had more control over assessment practices. Only those teachers in leadership positions shared that they have a role in the decision-making process for assessment practices at the school level. These findings extended knowledge and confirmed the works of several researchers who examined teachers' agency to assess student needs and autonomy in curricular decisions. Golden (2018) asserted that reduced autonomy in curricular decisions about assessment contributes to a diminishing agency to determine student needs. Mandated assessments and schedules pressure teachers to assess their students in a particular way, thereby reducing teacher agency concerning compliance. Furthermore, the ability to explicate students' needs is a prerequisite of agency in mathematics teaching practices (Bobis et al., 2019). This theme relates to Fullan et al.'s (2006) three Ps model principles. The authors emphasized that to make personalization a reality, it must be a collective and individual approach between the student, the household, and the school.

Theme 6 encompassed teachers' use of data to understand their students better. Some teachers in the study expressed concerns about whether students can translate data into meaningful practice, whereas others succeeded. According to participants, incentives, such as extra course credits, boosted student participation and interest in the evaluation of assessment data. Some teachers noticed apathy among students pertaining

to evaluating assessment data for growth purposes. These findings confirmed the work of McMillan (2018), who found that making students a part of an assessment feedback loop activates student learning by allowing them to apply data generated in a meaningful way. Similarly, McLoughlin and Lee (2008) determined that informal discussions with students regarding strengths and weaknesses helped students to achieve personal goals.

These findings confirm the principles of Fullan et al.'s (2006) three Ps model because they demonstrate how teachers transform classroom instruction using a precision-based process. Furthermore, the findings of this study provided answers for RQ2 because the information obtained from the participants provided information regarding how teachers choose personalized instructional strategies based on students' assessment data. Evidence from the literature suggests that increased student performance levels are aligned with personalized assessments (Arnesen et al., 2019). The themes developed in alignment with RQ2 provided information that helped to understand the perceptions of mathematics teachers concerning how teachers select instructional strategies.

Limitations of the Study

A limitation of this study was its small sample size. Data obtained from studies with small sample sizes may be less reliable than those with larger sample sizes (Creswell & Creswell, 2017). The qualitative nature of the study places limitations on the data findings and limits the projection to smaller sample populations. The study was also limited by the technique used for data analysis. Thematic data analysis is more subjective

than quantitative modes of analysis and, therefore, less reliable (Creswell & Creswell, 2017).

Recommendations

The findings of this study support and extend knowledge on the topic of teachers' assessment data usage. In this study, I examined teachers' perceptions of assessment data usage and instructional strategies used in middle school mathematics. Moreover, relatively little is known about how teachers use assessment data to inform instructional decisions. Using a basic qualitative inquiry approach, I conducted interviews with eight middle school mathematics teachers, and I was able to produce six themes. The qualitative data analysis was limited to the perceptions and experiences of those eight participants. Insights from this study enabled me to develop the following recommendations for practice: (a) teachers should incorporate both students and parents into the assessment data analysis process as a triangulated approach to precise, data-driven instruction; (b) teachers should plan appropriately timed assessments that allow for ample time to analyze assessment results to inform instructional practices; (c) teachers should use student opinion as a metric for determining the choice of assessments and effectiveness of instructional strategy employed; (d) teachers should be granted more autonomy over high stakes assessment decisions that affect their students, and (e) teachers should agree upon a determinant percentage for remediation.

Recommendations for further research on this topic of assessment data usage to inform instructional decisions include (a) replicating the qualitative analysis with a larger sample size, (b) conducting qualitative interviews with both teachers and students to

gather their perceptions and experiences with assessment data usage, and (c) conducting quantitative analysis of students' performance trends relative to teachers' assessment data usage and instructional strategies employed.

Implications

This study contributes to filling a gap in the current literature on the topic of assessment data usage. There were limited studies on how middle-grade mathematics teachers use assessment data to inform instructional strategies. This study has the potential to bring about social change in several ways. This study highlights the perceptions and experiences of middle grades mathematics teachers, which revealed information about teachers' approaches to assessment and instructional strategies. Classroom teachers will benefit by better interpreting lapses in understanding shown in student performance levels to inform instructional strategies and future assessment use (see McGlynn & Kelly, 2017). Moreover, as teachers hone their abilities to interpret these knowledge gaps, they become vectors of social change. The shared experiences, strategies, and perceptions of the participants may contribute to helping mathematics teachers more precisely diagnose the instructional needs of their students through assessment data usage.

This study may have methodological implications because researchers can replicate similar studies with teachers of various subject matter areas. Extending the analysis to reflect a broader scope of perspectives would make the study's findings more applicable to other settings. The methodology used in this study allowed me to gather details from the mathematics teachers via individual interviews. This basic qualitative

data design was an apt design for obtaining teachers' perceptions regarding assessment data usage to ascertain patterns in determining instructional strategies.

The conceptual framework for this study was based on Fullan et al.'s (2006) principles of establishing a data-driven instructional approach with an emphasis on continually providing precise and personalized instruction for students. Pinger et al.'s (2018) research further supported this notion that teachers should provide frequent, specific, and personalized instruction that is based on assessment data. Furthermore, studies revealed that teachers are using methods that are out of sync with the current education setting (Hanushek et al., 2019). Teaching practices should adapt according to the continual evolution within the field of education. Fullan et al.'s (2006) three Ps could be successfully applied to other fields concerning data management and linking data to professional practice.

Conclusion

In this study, I examined teachers' perceptions of assessment data usage and instructional strategies used in middle school mathematics. The conceptual framework for this study was Fullan et al.'s (2006) three Ps model. I used this model as a mechanism for understanding how teachers can be effective at using assessment data. Participants' data were interpreted in light of these principles. There was limited knowledge within the field of education concerning how teachers use assessment, and previous studies placed little emphasis on teachers' perceptions of assessment data usage and instructional strategies used in mathematics. Therefore, I conducted this study to contribute towards filling this gap in professional practice.

There is a continued phenomenon of interest concerning teachers' assessment data usage to inform instruction. Investigating teachers' perceptions of assessment data usage and instructional strategies used in mathematics provides information for other mathematics teachers operating in similar settings. Teachers and other key stakeholders can use the study's findings to optimize teacher and student agency.

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Appendix A: Alignment of Interview Questions to Research Questions

Research question	Corresponding interview question
Research Question 1: What are middle school mathematics teachers' perceptions of assessment data usage?	How does your planning differ when preparing to administer formative assessments when compared to summative assessments? What kinds of assessments tell you the most about what students are learning? When might you differentiate assessments for your students? How do you use assessment data in your classroom?
Research Question 2: How do middle school mathematics teachers choose personalized instructional strategies based on students' assessment data?	What motivates you to employ innovative instructional strategies in your teaching? What instructional strategies do teachers in your department use for improving assessment? Do you believe that these strategies are effective? Why or why not? Specifically, what instructional strategies and assessments have you used in your classroom? Describe the instructional and assessment practices at your school. What instructional strategies do you use between assessments? How do you decide which instructional strategies to employ? Which instructional strategies do you use when checking for student comprehension of a concept? What involvement do you have in the evaluation of instructional and assessment practices at the school?

Note. I also asked two questions for descriptive purposes: (a) How long have you been in your current position? and (b) What involvement do you have in the evaluation of instructional and assessment practices at the school?

Appendix B: Research Questions and Interview Protocol

In this basic qualitative study, I examined the perspectives of middle school mathematics teachers as they pertain to assessment data usage and the selection of instructional strategies. I used an interview protocol to obtain data to answer the two guiding research questions.

Research Questions

RQ1: What are middle school mathematics teachers' perceptions of assessment data usage?

RQ2: How do middle school mathematics teachers choose personalized instructional strategies based on students' assessment data?

Interview Protocol

1. How long have you been in your current position? (for background purposes)
2. What involvement do you have in the evaluation of instructional and assessment practices at the school? (for background purposes)
3. What motivates you to employ innovative instructional strategies in your teaching? (RQ2)
4. What instructional strategies do teachers in your department use for improving assessment? (RQ2)
5. Do you believe that these strategies are effective? Why or why not? (RQ2)
6. Specifically, what instructional strategies and assessments have you used in your classroom? (RQ2)

7. Describe the instructional and assessment practices at your school. (RQ1 & RQ2)
8. How does your planning differ when preparing to administer formative assessments when compared to summative assessments? (RQ1)
9. What instructional strategies do you use between assessments? (RQ2)
10. How do you decide which instructional strategies to employ? (RQ2)
11. Which instructional strategies do you use when checking for student comprehension of a concept? (RQ2)
12. What kinds of assessments tell you the most about what students are learning? (RQ1)
13. When might you differentiate assessments for your students? (RQ1)
14. How do you use assessment data in your classroom? (RQ1)