INSTRUCTIONAL DECISIONS PRIMARY TEACHERS MAKE TO ACCOUNT FOR STUDENT ENGAGEMENT IN MATHEMATICS

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ABSTRACT

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This qualitative case study explored instructional decisions exemplary primary teachers (kindergarten-third grade) made in order to engage students in mathematics. The phenomenon of teachers altering, supplementing, or utilizing district-given materials to support student engagement and understanding was studied. Specifically, this involved determining what math resources teachers were given, and what materials they were using. The participants included five primary teachers in three different schools within two school districts. The findings revealed teachers' instructional decisions were influenced by the school setting and expectations, students' needs and interests, and prior experiences and preparedness. The teachers shared engagement strategies they utilized, such as hands-on experiences, student choices, movement, discussions (collaboration and questioning), emotional connections, ownership of learning, and differentiation. Teachers described their level of creative control as it related to adhering to the district math program, or having had the opportunity to make significant changes. Teachers also shared their definitions of student engagement. Similar to the research surrounding student engagement, they discussed aspects of behavioral engagement, cognitive engagement, and emotional engagement. The research referenced in this study demonstrated the importance of student engagement in primary classrooms. Student engagement in the primary classrooms has been found to support math achievement and future student engagement in subsequent grade levels. This study adds to the body of knowledge regarding teachers' instructional decisions to support student engagement in the primary grades.

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I would like to dedicate this work to my wonderful husband and incredible parents for making this possible. Thank you for your unwavering support to make this dream a reality. I can't thank you enough for being by my side each step of the way.

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CHAPTER 1

OVERVIEW OF THE STUDY

Student engagement research has grown in popularity over the last three decades due to its potential to address educational problems such as drop-out rates, declining motivation and academic achievement, and high rates of student boredom (Fredricks et al., 2016; Ladd & Dinella, 2009; Lei et al., 2018; Wang & Fredricks, 2014). Several studies have noted increased student engagement is correlated with increased academic achievement (Abbott et al., 2017; Archambault et al., 2016; Wang & Holcombe, 2010) and future achievement (Hughes et al., 2008; Saeed & Zyngier, 2012). However, a consensus of a student engagement definition remains unclear.

Multiple definitions of student engagement exist. For the purpose of this paper, student engagement will be defined in alignment with Fredrick et al.'s (2004) commonly accepted three-part definition. Student engagement is often defined as a multidimensional construct including behavior, cognitive, and emotional engagement (Fredricks et al., 2004; Rimm-Kaufmann et al., 2015; Skinner et al., 2009). Behavioral engagement refers to paying attention, following directions, and the degree to which a student participates in academic and nonacademic activities in school (De Laet et al., 2015). Cognitive engagement refers to "cognitive and self-regulation strategies used by students in their learning processes" (Lei et al., 2018, p. 519). Emotional engagement refers to students' feelings and attitudes towards school, including teacher or peer connections or valuing school (Barghaus et al., 2017). In this study, student engagement is defined as behavioral, cognitive, and emotional engagement.

Research frequently highlights the impact of engagement and the concerns of disengagement. Student engagement research often addresses academic (i.e., achievement

success and test scores) and nonacademic (i.e., teacher and peer relationships) components of school. There is less research focusing on instructional decisions teachers make to actively enhance student engagement.

Historical Roots of Student Engagement

Student engagement has a deep and rich history. Many classical theorists have paved the way with their approaches to engage students in the learning process. These individuals have helped shape the field to what it is today, and their ideas have withstood the test of time. To cite several examples, the works of Jean Rousseau (1712-1778), Johann Heinrich Pestalozzi (1746-1827), Friedrich Froebel (1782-1852), John Dewey (1859-1952), and Jean Piaget (1896-1980) are relevant in today's classroom context. The concepts of play, collaboration, and hands-on experiences are deep-rooted ideas that have been seen to reemerge in different eras (Dewey, 1938; Froebel, 1887; Pestalozzi, 1898; Piaget, 1977; Rousseau, 1979). Student engagement practices seem to appear cyclically, recreating the philosophical trends of the past.

Today's seminal authors echo Piaget's and Dewey's call for hands-on experiences, Rousseau's and Froebel's need for play, and Pestalozzi's need for an emotional connection with students. Historical threads of the past are weaved into the daily culture of classrooms. Much of Jennifer Fredricks' research on engagement reverberates Pestalozzi's notion of the importance of students feeling emotionally and socially connected to the classroom, peers, and teachers. Positive and meaningful relationships are critical components of engagement and learning. Teachers that are supportive, caring, and encouraging positively impact behavioral, emotional, and cognitive engagement (Fredricks et al., 2018). Additionally, Ellen Skinner is often cited for her work on student motivation and engagement. She discusses the importance of student engagement as being multi-faceted. She also discusses the importance of students being

enthusiastic, motivated, and 'hands-on' with their learning, correspondingly to the ideals of Dewey and Froebel.

Purpose of the Study

The purpose of this study was to explore and gain a deeper understanding of instructional decisions primary teachers made in order to engage students in mathematics. The phenomenon of teachers altering, supplementing, or utilizing district-given materials to support student engagement and understanding was studied. Specifically, this involved determining what math resources teachers were given, and what materials they were putting into practice to support student engagement.

Statement of Need

A great deal of research exists surrounding student engagement. However, much of the research centers on middle and high school students. Less student engagement research has focused on elementary students, and even fewer studies have focused on primary-aged students. For the purpose of this paper, primary grades included kindergarten, first, second, and third grade.

Research to date has largely been quantitative in nature and centered around student engagement in relation to academic achievement. This includes research linking student engagement and academic grades, achievement test scores, and school completion rates (Dotterer & Lowe, 2011; Fredricks et al., 2016; Klem & Connell, 2004; Skinner et al., 2008).

Social and emotional features have also been largely studied in connection with student engagement. Aspects of this research include teacher-student relationship quality (Blazar and Kraft, 2017; Martin & Rimm-Kaufman, 2015; Wu, 2010) and peer relationships (Archambault et al., 2016; De Laet et al., 2015; Yang et al., 2018).

Benefits of student engagement and the consequences of disengagement have long been documented as well (Buhs et al., 2018; Reyes et al., 2012; Rimm-Kaufman et al., 2015). Student engagement as a research topic has grown in popularity as it is a fundamental contributor to learning and academic success (Fredricks et al., 2016; Ladd & Dinella, 2009). Engagement as an intervention strategy is often appealing because it is considered malleable. It can be shaped by teaching and school practices (Fredricks et al., 2016).

Further research is needed to address the manner in which primary teachers purposefully account for student engagement during math instruction. After a thorough review of literature, a gap seemed to exist regarding instructional decisions teachers are making to alter or utilize district-given materials to support student engagement in the area of primary math. Specifically, it is not known what math resources teachers at a specific school district are *given* and what they are *using*.

It is hoped this research can have practical implications in the classroom. The perspectives and instructional practices of the participants may shed light on engagement strategies classroom teachers may consider implementing to teach math content in a meaningful and engaging way for their students. Additionally, schools or school districts may be invested in the outcome as to 'what works' for students, especially when faced with decisions to purchase or provide learning materials for their teachers.

Statement of the Problem

Current research has predominately utilized empirical research methodologies and methods (i.e., longitudinal, cross-sectional, and experimental designs) to study student engagement. Empirical research in education aims to "yield probabilistic, formal, theoretical, explanatory and warrant truths/knowledge claims obtained as a result of experiment, analysis of

variables, or causal-comparative studies within the theoretical boundaries delineated by each individual project" (Lukenchuk & Kolich, 2013, p. 66).

This research primarily focuses on quantitative data relating to achievement grades (Heatly et al., 2015; Luo et al., 2009; Palardy & Rumberger, 2008), test scores (Bodovski & Farkas, 2007; Bottia et al., 2014; Stipek & Chiatovich, 2017), and measuring aspects of teacher-student relationship quality (Engels et al., 2021; Hamre & Pianta, 2001; Kiuru et al., 2015; Rudasill et al., 2011; Wu et al., 2010). A shortfall of this research is that the perspectives and voices of primary teachers are not included. It emphasizes quantifiable aspects of engagement and does not account for the instructional decisions teachers actively make to promote student engagement. It also fails to mention how teachers alter or utilize instructional materials to intentionally plan for and enhance engagement. Stipek and Chiatovich (2017) echo this problem by stating:

> Most studies that have demonstrated teacher effects on academic achievement have been conducted by economists who assess teacher effectiveness solely on the basis of their students' achievement gains…Although useful in demonstrating that teachers matter, these studies do not help identify effective teachers in advance of examining student learning gains, and they provide no information on the practices employed by effective and ineffective teachers. (p. 774)

Similarly, Fatou and Kubiszewski (2018) call for more research regarding factors that sustain and promote student engagement in school.

Therefore, an interpretative design for looking at the problem allows for multiple voices and perspectives to shine through. Interpretivism accepts reality is socially constructed, or multiple realities exist (Merriam & Tisdell, 2016). Lukenchuk and Kolich (2013) explain the

purpose of interpretivism as, “understanding underscores the nature and type of knowledge uniquely attributed to this paradigm” (p. 69). Thus, this study included multiple perspectives of teachers, and aimed to provide a deeper understanding of instructional decisions to support student engagement.

Engagement practices are countless. Teachers bring different perspectives and skillsets to the classroom. One teacher’s engagement practices may look very different from another’s. Rooted in the interpretive paradigm, this study encompassed multiple perspectives of what it means to engage students.

Currently, limited information is available regarding the manner in which teachers intentionally plan and incorporate student engagement in their instruction. Specifically, this has not been addressed in the realm of primary education through the lens of interpretivism. While the benefits of engagement have been addressed, it is not yet known how exemplary primary teachers in the American Southwest intentionally plan and make instructional decisions to alter, supplement, or utilize district-given instructional materials to enhance math student engagement. For the purpose of this paper, exemplary teachers refers to teachers who received above average marks (i.e., proficient, outstanding, or highly effective) in the category of student engagement according to their district’s teacher evaluation.

Research Questions

1.) What instructional decisions are exemplary teachers making to engage students in the area of primary math?
    a. How do primary teachers define student engagement?
2.) What changes, if any, to district-provided instructional materials are exemplary teachers making with the intention to enhance student engagement in primary math?

Significance of the Study

Primary student engagement is worthy of study, as it is has been linked with student achievement (Archambault & Dupéré, 2017; Stipek & Chiatovich, 2017). Research indicates early academic success in elementary school is positively correlated to future achievement (Bodovski & Farkas, 2007; Luo et al., 2009; Park et al., 2016). Thus, early student engagement has the potential to shape the trajectory for a student's educational career.

Primary grades serve as the foundation in a child's education. Early school experiences such as teacher-student interactions have implications for later teacher-student interactions (Rudasill, 2011). In a longitudinal study involving a kindergarten class of 179 children, Hamre and Pianta (2001) found, "children's ability to form relationships with their teachers forecasts later academic and behavioral adjustment in school" (p. 634).

Thus, primary teachers may hold power to shape the context of classroom experiences. This may relate to their relationship quality with students, instructional practices, selection of materials, and their expectations of students.

Math is exclusively targeted in this study because early math achievement is a strong predictor of math achievement through high school (Gunderson et al., 2018). In a meta-analysis involving six large-scale longitudinal data sets, Duncan et al. (2007) found early math skills such as number sense and ordinality were the strongest predictors for later learning, followed by reading, and subsequently attention skills. Yet, math is often associated with negative attitudes and feelings of anxiety for both children and adults (Shadden, 2018; Sorvo et al., 2017). Students experiencing math anxiety tend to avoid settings that involve math, including math-related classes, tasks, and potential career options (Gunderson et al., 2018; Ramirez et al., 2016; Tomasetto et al., 2021). Research reveals students as young as six or seven may experience math

anxiety, and this anxiety has the potential to hinder new learning (Gunderson et al., 2018; Sorvo et al., 2017; Tomasetto et al., 2021).

This study involved working with 'exemplary' teachers, or teachers that have earned high ratings (i.e., proficient, outstanding, or highly effective) on their teacher evaluation in the area of student engagement practices. The purpose of working with 'exemplary' teachers was to gain insight as to how highly effective teachers engaged students in math.

Examining ways in which exemplary teachers explicitly accounted for student engagement in primary math added to the body of knowledge regarding best classroom practices. This study has the potential to support current and future engagement.

Definition of Terms

Behavioral engagement: A student's behavioral disposition and conduct, such as paying attention, participating in lessons, compliance to rules and instruction, attendance, and exerting effort with classroom assignments (Archambault & Dupéré, 2017; Van Uden et al., 2014).

Cognitive engagement: Self-regulating behaviors, monitoring own learning, putting forth mental effort, and wanting to achieve academic success (Archambault & Dupéré, 2017; Van Uden et al., 2014)

Emotional engagement: Students' feelings and attitudes towards the classroom. This dimension is associated with feelings of belonging, demonstrating a positive attitude towards the classroom, such as displaying enthusiasm or having positive relationships with peers and teachers (Archambault and Dupéré, 2017; Van Uden et al., 2014).

Exemplary teachers: Teachers who receive above average marks (i.e., proficient, outstanding, or highly effective) in the category of student engagement according to their district's teacher evaluation.

Instructional decisions: Making informed choices concerning methods of instruction (Wilson, 2021).

Instructional materials: Resources a teacher uses (e.g., textbooks, manipulatives, videos, and songs).

Primary grades: Kindergarten, first grade, second grade, and third grade

Student engagement: A multidimensional construct involving three distinct yet interrelated dimensions including behavioral engagement, cognitive engagement, and emotional engagement (Fredricks et al., 2016).

Study Design

This study was positioned within the interpretative paradigm. This indicates the researcher accepts "that reality is socially constructed; that is, there is no single, observable reality. Rather, there are multiple realities, or interpretations, of a single event" (Merriam & Tisdell, 2016, p. 9). Creswell (2013) explains interpretive research is chiefly concerned with gaining a deep level of understanding.

Case study was the selected methodology for this study. Case study research is a qualitative approach that "investigates a contemporary phenomenon (the "case") in depth and within its real-world context" (Yin, 2018, p. 15). Aligning with the purpose of case study, the intent of this case study was to develop an in-depth understanding of instructional decisions primary teachers made to engage students in mathematics.

Prior to the study, a bracketing interview was conducted to address held biases of the researcher. A pilot study was also conducted to refine the study's procedures, including the initial participant questionnaire and interview protocol.

The study involved purposeful sampling. The researcher recruited participants by contacting elementary school principals within two school districts. An email was sent explaining the study, sharing participation requirements, and ultimately asking principals to refer three primary teachers to contact regarding participation. Follow up contact to principals was made via phone and/or email as necessary.

From the list of three names, one teacher was randomly contacted for participation. If the first teacher did not wish to participate, another person on the list was contacted randomly. If the second individual also did not wish to participate, the last teacher was contacted. If all three teachers declined participation, the researcher contacted different principals and teachers.

Additionally, snowball sampling was utilized to access more potential participants. Participating teachers had the option to nominate a colleague that fit the requirements for participation. One teacher was recruited through snowball sampling. It was hoped five to eight participants would be included in the study. Ultimately, after eleven months of recruitment, the sample size included five participants. Teachers from three different schools within two school districts participated. By working with teachers at different schools and school districts, multiple perspectives emerged.

The requirements included the school district must be a (a) public school and (b) have adopted a math program. Individual participants must (a) teach either kindergarten, first, second, or third grade general education, (b), teach math, (c) deemed an exemplary teacher by receiving high ratings on annual teacher evaluation form in the area of student engagement practices, and (d) teachers at the selected school have some flexibility to choose appropriate math learning materials.

Semi-structured interviews were the primary method for data collection. The interviews were guided by a list of questions and probes. A semi-structured interview "allows the researcher to respond to the situation at hand, to the emerging worldview of the respondent, and to the new ideas on the topic" (Merriam & Tisdell, 2016, p. 111). Interviews were recorded and transcribed verbatim. A questionnaire was also given to participants to collect necessary background information, and to ensure they met the requirements for study participation.

Data collected from interviews were analyzed. This data focused on primary teachers' instructional decisions and math engagement strategies to answer the research questions. Data were first analyzed using Glaser and Strauss' (1967) constant comparative method. This method allowed the researcher to begin coding data as soon it was collected. Additionally, the researcher was able to compare data and note similarities and differences. Open coding, axial coding, and selective coding were utilized to create and refine categories and themes.

Triangulation was accomplished through member checking, collaborating with a second coder, and utilizing multiple methods of data collection. Member checking involved participants being given a copy of their interview transcript. They had the opportunity to add, delete, or modify their transcript. A second coder coded the data separately from the researcher. Following, codes were compared for agreement. Multiple methods of data collection were utilized to confirm findings. The questionnaire and the interview protocol were used to compare and check against one another. Additionally, having an outside person (i.e., principals or colleagues) nominate participants supported triangulation of data collection. The selected participants were deemed 'exemplary' in the eyes of their peers or leadership team.

Limitations

This study utilized a case study design. The case was bound by both time (2021-2022 and 2022-2023 school years) and place (two school districts in the American Southwest), limiting participation. A limited number of participants (five) were involved in this study. The perspectives represented a small sample size and cannot be generalized.

A limitation involved the participant requirements. Participants had to (1) be a general education teacher, (2) teach a primary grade (kindergarten, first, second, or third grade), and (3) teach math during a typical school day. Additionally, (4) teachers had to have some degree of creative control in selecting instructional materials to teach math. Finally, (5) teachers had to be deemed as 'exemplary' with implementing student engagement strategies. To be considered 'exemplary', teachers had to receive an above average rating on their annual teacher evaluation in the area of student engagement.

Adding to the limitation above (#5), because teachers were identified by their principals, senior figures, or colleagues as employing exemplary student engagement practices during math instruction, the researcher was dependent on these individuals' understanding and judgement of student engagement practices.

Another limitation is the term 'exemplary' was loosely defined in this study. A concise definition of 'exemplary' was not given to the principals, senior figures, and colleagues. Instead, they were asked to determine teachers' student engagement practices in relation to their district evaluation rubric.

Another limitation was the selected school districts must have been a public school districts and had adopted a math program. This math program must have been available to the participants.

An additional limitation was the researcher was relying on participants to answer questions honestly. Teachers were self-reporting. It was hoped teachers were sharing their actual classroom practices, not a textbook answer of student engagement.

The restrictive time frame was another limitation. Interview data were gathered within an eleven-month time frame. Participation was limited to those teachers available during this time.

The study involved 'one-shot' interviews. With a limited time frame, follow-up interviews were not conducted. Additional interviews may have allowed the researcher to delve deeper in understanding based on initial interview findings.

Lastly, it is important to acknowledge the limitation that engagement also resides within the child. It is not solely the responsibility of teachers, rather, students play an essential role in student engagement. Students have their own autonomy regarding their efforts to be engaged. This may be in the form of self-regulation and/or exerting effort to engage in learning. This study did not address student perspectives but instead focused on teachers' perspectives and practices.

Summary

Student engagement has practical implications from the time a child enters preschool to the time they graduate. Student engagement has been widely accepted as a malleable process that can support student achievement. The benefits of student engagement and the consequences of disengagement have been well documented in the research, including its relation to high school completion, academic success, and emotional connection to peers and teachers.

A great deal of student engagement research involves aspects of behavioral, cognitive, and emotional engagement. Often the studies are empirical, assigning numeric value to student engagement's correlation to test scores or teacher-student relationships. Considerably more

student engagement research focuses on middle and high school students and less is available concerning elementary students, especially those in primary grades.

While much research supports incorporating student engagement practices in the classroom, it is not clear how primary teachers intentionally plan their math instruction to enhance student engagement. Teachers actively make instructional decisions regarding which materials to use, alter, or forgo. These decisions impact instruction and ultimately may influence achievement.

This interpretative study utilized a case study methodology to better understand instructional decisions primary teachers made in order to engage students in mathematics. The phenomenon of teachers altering or utilizing district-given materials to support student engagement and understanding was the focus of the study.

CHAPTER 2

REVIEW OF LITERATURE

Chapter 1 addressed an overview of the study, a brief history of student engagement, and a peek into current student engagement research. This review of the literature serves to provide readers with a background of student engagement from preschool through high school, the impact of engagement and disengagement, and the importance of engaging young elementary learners to set them up for current and future academic success. The research section focuses on instructional decisions teachers are making to engage students in the area of primary math, which was the focus of this dissertation. The seminal research section encompasses notable studies in the student engagement field.

A significant body of research focuses on student engagement. However key terms and defining student engagement vary in the research. Student engagement is often viewed as a multidimensional construct (Guo et al., 2015). For the purpose of this paper, engagement will be defined in alignment with Fredricks et al.'s (2004) three-part definition including behavioral, cognitive, and emotional engagement. Van Uden et al. (2014) and Archambault and Dupéré (2017) provide an explanation for the three types of engagement. *Behavioral engagement* refers to a student's behavioral disposition and conduct, such as participating in lessons, compliance to rules and instruction, attendance, and exerting effort with classroom assignments. *Emotional engagement* refers to students' feelings and attitudes towards the classroom. This dimension is associated with feelings of belonging, demonstrating a positive attitude towards the classroom, such as displaying enthusiasm or having positive relationships with peers and teachers. *Cognitive engagement* refers to self-regulating behaviors, monitoring own learning, putting forth mental effort, and wanting to achieve academic success.

Definitions of Student Engagement

Definitions of student engagement are loosely defined and there is no universally accepted definition (Hirschfield & Gasper, 2011; Lester, 2013). However, a three-part definition of engagement is most common. Researchers tend to view student engagement as multifaced, focusing on the behavioral, cognitive, and emotional engagement (Fredricks et al., 2004; Rimm-Kaufman et al., 2015; Skinner et al., 2009). The three types of engagement do not operate in isolation and may overlap depending on the context. Rimm-Kaufman et al. (2015) references Fredricks et al. (2004) when defining behavioral, cognitive, and emotional engagement:

> Behavioral engagement refers to paying attention, completing assigned work, participating in teacher-sanctioned learning opportunities, and showing an absence of disruptive behaviors. Cognitive engagement refers to a willingness to exert effort to understand content, work through difficult problems, and manage and direct their attention toward the task at hand. Emotional engagement refers to feelings of connection to content, interest in learning, and enjoyment of solving problems and thinking about content. (pp. 2-3)

It is important to note *emotional engagement* and *affective engagement* are used interchangeably in research. Similar to *emotional engagement, affective engagement* refers to the interest, emotions, curiosity, and enthusiasm of the learner (Parsons et al., 2014). Student engagement does not necessarily impact all three areas of engagement at the same time. Student engagement may intersect in the three areas but is not mandatory for engagement to occur. Additionally, student engagement is a fluid state of being (Quin, 2017). A student is not exclusively engaged or disengaged. This state can change constantly. A student may move through periods of active

or inactive engagement throughout the course of a day or even during a brief fifteen-minute lesson.

In addition to behavioral, cognitive, and emotional engagement, various other researchers include *social engagement.* Social engagement is defined as "the quality of social interactions and the social forms of engagement around classroom tasks" (Fredricks et al., 2018, p. 272). Similarly, Rimm-Kaufman (2015) defines social engagement as "students' day-to-day social exchanges with peers that are tethered to the instructional content" (pp. 2-3).

Parsons and Taylor (2011) note an abundance of engagement definitions exist including academic, cognitive, intellectual, institutional, emotional, behavioral, social, and psychological engagement. However, they question with so many types, does a learner need to function in *all* areas of student engagement to be successful? It appears studies may focus on only one to a few aspects of student engagement. For example, a study may solely focus on emotional engagement responses of students.

Importance of Student Engagement

Existing research showcases student engagement as a critical component for learning and school success (Dotterer & Lowe, 2011; Reyes et al., 2012; Rimm-Kaufman et al., 2015; Saeed & Zyngier, 2012; Skinner et al., 2008). "Engaged students are attentive and participate in class discussions, exert effort in class activities, and exhibit interest and motivation to learn" (Reyes et al., 2012, p. 700). Student engagement is relevant in all grade levels, ranging from preschool through high school. In elementary school, young students who "stay on task, attend to learning goals, and participate actively in the learning experience show better academic achievement" (Rimm-Kaufman et al., 2015, p. 171). Following, Klem and Connell (2004) found middle school students with higher levels of engagement were 75% more likely to have higher grades and

attend school regularly than students with lower levels of engagement. At the high school level, student engagement has been found to relate to the likeliness of high school competition (Dotterer & Lowe, 2011; Fredricks et al., 2004).

Skinner et al. (2008) detail both short-term and long-term goals in relation to student engagement. In the short term, student engagement has been linked to higher grades, better attendance, and higher achievement test scores. In the long term, "it predicts patterns of attendance, retention, graduation, and academic resilience" (Skinner et al., 2008, p. 765). Similarly, Dotterer and Lowe (2011) found students' attitudes and feelings about their school experience impacts their academic outcomes, including achievement and high school completion.

Student engagement is viewed as an essential construct between researchers, teachers, interventionists, parents, and stakeholders (Carter et al., 2012). Student engagement takes many forms, making it customizable and practical for implementation. Additionally, Carter et al. (2012) note student engagement behaviors are easily recognizable by teachers, making it apparent 'what works' for students and what does not.

Disengaged Students

While the benefits of student engagement are known, the pitfalls of disengagement are also visible. One key finding in student engagement research is students tend to become more disengaged as they age and advance in grade levels (Buhs et al., 2018; Orthner et al., 2013; Wang & Fredricks, 2014). Fredricks et al. (2011) state, "Unfortunately, there is evidence that many students are not engaged in school, and students become more disengaged as they progress from elementary through middle school" (p. 328). Similarly, Skinner et al. (2008) found a significant decline in student interest, motivation, and enthusiasm during the middle school to

high school transition. The consequences of disengagement range from boredom to early withdrawal from school (Dotterer & Lowe, 2011; Skinner et al., 2009).

Research reveals disengagement is more prevalent for males and for students from low socioeconomic backgrounds (Skinner et al., 2008). Students from underprivileged backgrounds are also at a higher risk. Fredricks et al. (2011) references the National Research Council (2004) in finding, "These youth are less likely to graduate from high school and face limited employment prospects, increasing their risk for poverty, poorer health, and involvement in the criminal justice system" (p. 328). Additionally, Dotterer and Lowe (2011) state previous research has linked school disengagement and adolescent outcomes with school dropout, substance abuse, and mental health problems.

Student Engagement from Early Childhood to High School

This portion of the literature review focuses on student engagement in the general sense. The purpose is to discuss student engagement in relation to behavioral, cognitive, and emotional engagement ranging from early childhood to high school. An overarching theme in the literature is the significance of student engagement in the classroom at every age and grade level. Another important finding is student engagement in the earlier grades can lead to further engagement in subsequent grade levels and can therefore shape the trajectory for a student's schooling career (Bodovski & Farkas, 2007; Luo et al., 2009).

Student Engagement in Early Childhood

According to the National Association for the Education of Young Children (NAEYC, n.d.) early childhood is a foundational stage of life ranging from birth to eight years of age. In the classroom setting, this age range includes students from preschool to 3rd grade. This period is marked by extensive growth, including social, emotional, physical, and mental development. The

average preschool entrance age range is three to four years old and is typically a child's first experience in a school setting. Student engagement research extends to the youngest of learners, showcasing the importance of behavioral, cognitive, and emotional engagement during these early years of life and the impact it has on their future. Heatly et al. (2017) note, "Early engagement patterns set the stage for short and long-term academic behaviors and progress" (p. 1045). Thus, early childhood student engagement is important for captivating impressionable young learners and paving the way for their educational career.

Behavioral Engagement in Early Childhood

Most young learners come to school eager and excited to learn (Heatly et al., 2017). Nelson et al. (2017) found children's learning-related behaviors predict school success more so than IQ or the classroom environment. Students with positive behaviors demonstrate increased engagement more than their peers with disruptive behaviors (Williford et al., 2018).

Disruptive behaviors are associated with less engagement with learning tasks and activities (Williford et al., 2018). Additionally, students displaying disruptive behaviors engage less positively with teachers and peers and are at risk for later dropping out of school (Garrett-Peters et al., 2019; Williford et al., 2018). Heatly et al. (2017) found kindergarteners who are argumentative or are more prone to conflict are less likely to be behaviorally or emotionally engaged in learning and more likely to have academic avoidance. Similarly, McKinnon and Blair (2018) state, "children who are less adept at controlling impulsive and aggressive behaviors may struggle to develop positive, warm relationships with teachers" (p. 2055). Poor behavioral engagement can therefore impact relationships and contribute to disengagement. Transitioning from kindergarten to first grade, Heatly et al. (2017) also found engagement tends to diminish, which can elevate negative school behaviors.

Cognitive Engagement in Early Childhood

Preschoolers with stable home environments are reported to have higher levels of cognitive development than those children who experience household chaos (Garrett-Peters et al., 2019). Household chaos is marked by disorder/disorganization and instability/turbulence (Garrett-Peters et al., 2019). School-age children in homes with household chaos also experience lower academic proficiencies and negative socioemotional outcomes (Evans et al., 1999; Garrett-Peters et al., 2019). Students may be overwhelmed by excessive stimulation at home and withdraw. This withdrawn behavior may continue in the classroom and be a source for disengagement (Brooks-Gunn et al., 2010; Evans et al., 1999; Garrett-Peters et al., 2019). Household chaos can occur regardless of socioeconomic status (SES), although families with lower SES tend to experience more chaos due to parents potentially working multiple jobs, working atypical hours, or residing with multiple extended family members to reduce the cost of living (Evans et al., 2005; Garrett-Peters et al., 2019). McKinnon and Blair (2018) explain, "children from low-SES families are at-risk of having fewer of the skills necessary for early academic success, including lower EF [executive function] and lower quality relationships with teachers" (p. 2054). In this sense, SES can play a role in the classroom.

Executive function is a set of cognitive processes having three distinct components: working memory, cognitive flexibility, and inhibitory control (Little et al., 2017; Morgan et al., 2019; Willoughby et al., 2012). *Working memory* is the ability to hold and manipulate information in your mind during a brief time and update responses using new information. *Cognitive flexibility* is the ability to shift your attention and perspectives. Lastly, *inhibitory control* is the ability to remain focused on tasks when distractions are present (Little et al., 2017; Morgan et al., 2019).

In regard to executive function development, working memory progresses as children age into adolescence (Morgan et al., 2019). Morgan et al. (2019) explain, "inhibitory control grows rapidly during preschool but then slows as children age" (p. 21). Cognitive function develops linearly from age four through adolescence (Morgan et al., 2019). Little et al. (2017) explain executive function does not develop automatically, rather, the quality of the child's environment impacts its development. Establishing routines and structure assist in development, whereas chaotic environments and stress weakens brain development (Little et al., 2017). McKinnon and Blair (2018) demonstrate the importance of executive functioning (EF) by stating, "Unfortunately, children with lower EF are at higher risk of starting school with conflictual relationships with teachers, which may lead to cascading negative outcomes. Children starting school with lower EF may lack the skills to engage with the classroom" (p. 2063). This potential tension between students and teachers showcases EF as important not only in the realm of cognitive engagement, but also in relation to emotional engagement. Emotional engagement is believed to focus on relationships, including teacher-student connections.

Emotional Engagement in Early Childhood

Emotional engagement in early childhood is often marked by the quality of teacher-child relationships. McKinnon and Blair (2018) explain high-quality relationships provide young learners with security and independence. Students with positive teacher relationships tend to enjoy school and take more academic risks, whereas students with negative teacher relationships tend to defy classroom rules, resist working or staying on task, and require additional assistance to complete assignments (Hamre & Pianta, 2001; Heatly et al., 2017; McKinnon & Blair, 2018). Hamre and Pianta (2001) note students with stronger teacher relationships tend to have higher self-esteem, are more capable of developing peer relationships, and display self-reliance to

explore the classroom. Furthermore, students are witnesses to experience higher academic success with math, reading, and language development with positive teacher-student relationships (McKinon et al., 2018).

Peer relationships are also important at this age and can influence engagement and increase motivation. Working on group projects and collaborating with peers can increase persistence on activities (Master et al., 2017). Additionally, shared experiences and working towards a common goal may reinforce relationships (Grusec & Davidov, 2010). In one experiment, preschool-aged children completed puzzles as either believed to be assigned to a minimal group or without an assigned group identity. Students who were believed to be in a minimal group were witnessed to persist longer, showed increased motivation, and greater learning (Master & Walton, 2013). Baumeister and Leary (1995) explain belonging to a group is fundamental to human nature. Therefore, early childhood students desire to connect to others through social learning, seeking those with similarities (Master et al., 2017). However, it is important to note Master et al. (2017) found when children did not like their group members or identify with them, they were not motivated to work on the group's goals. Group make-up is consequently something to be taken into consideration.

Student Engagement in Upper Elementary School

While early childhood education refers to schooling from birth to eight years of age, or up until third grade (NAEYC, n.d.), upper elementary usually refers to grades 4^{th}-6^{th} . Students in this grouping are typically between the ages of nine and twelve. These are sometimes referred to as 'intermediate grades' as well. A distinction is made between lower and upper elementary school for several reasons. Chiefly, the academic and social demands are much different (Bryce et al., 2019). As an example, students are advancing their skillsets from learning how to read to

being fluent readers and gaining deeper levels of comprehension. Students are more self-directed as they progress from first grade to fifth (Bryce et al., 2019). Additionally, students may become less reliant on their parents for support as academic tasks grow more complex. Instead, parents and teachers may modify their approach to support their development of social and academic skills and gaining independence (Bryce et al., 2019).

Younger grades can be a precursor for future success. Archambault et al. (2016) reference Bodovski and Farkas (2007) and Ladd and Dinella (2009) by stating, "previous studies showed that, beyond demographic, cognitive, and family characteristics, elementary school students who like school and are cooperatively engaged in their classroom demonstrate greater levels of achievement over time" (p. 209). Moreover, research demonstrates student engagement in elementary school is associated with positive outcomes (Archambault et al., 2016; Bodovski & Farkas, 2007; De Laet et al., 2015).

The end of elementary school is important as it has implications for students transitioning into middle school (Archambault et al., 2016; Skinner et al., 2016). Fifth through eighth grade students with high and stable engagement were found to have higher academic grades (Li & Lerner, 2011). The experiences of upper elementary students can either advance or hinder their education. Behavioral, cognitive, and emotional engagement play a role in the daily experiences of these students and can have long term effects (Archambault & Dupéré, 2017; Hirschfield & Gasper, 2011).

Behavioral Engagement in Upper Elementary School

Considerable research supports the notion of behavioral engagement being linked to current and future academic success (Archambault & Dupéré, 2017; Guo et al., 2015; McClelland et al., 2007). In the upper elementary grades, behavioral engagement includes

following rules, participating, demonstrating positive classroom behavior, and complying with teachers' expectations (Bryce et al., 2019; McClelland et al, 2007). Archambault and Dupéré (2017) found students who exhibit qualities of behavioral engagement are more likely to achieve academically and graduate high school. Similarly, McClelland et at. (2007) found having strong behavioral regulation in elementary school is related to higher levels of academic achievement; "Acquiring behavioral regulation (including attention, working memory, and inhibitory control) provides a foundation for developing positive behavior in classroom contexts and making academic gains" (pp. 948-949). Guo et al. (2015) note behavioral engagement is associated specifically with reading achievement, both concurrently and longitudinally. Referencing Birch and Ladd (1997), De Laet et al. (2015) explain, "children who feel supported by their teacher tend to comply more easily with the teacher's expectations, which, in turn, reduces their involvement in off-task and deviant behaviors" (p. 1293). Student behavior can therefore support engagement. However, it can also obstruct one's academic success.

Children who lack behavioral engagement are at an increased risk for academic failure in elementary, middle, and high school (De Laet et al., 2015). Students exhibiting disruptive behaviors that distract from learning are predictably less behaviorally engaged as it undercuts their ability to focus, self-monitor, adapt to tasks and undermines the school environment (Archambault & Dupéré, 2017).

A lack of behavioral engagement in the beginning of the school year may perpetuate behavioral concerns. Cappella et al. (2013) found second through fifth graders with more behavioral problems in the fall were less behaviorally engaged in the spring.

Hirsch et al. (2018) explain a student may act out when faced with a difficult academic task. The child may demonstrate work avoidance or disrupt the learning environment. A student

who acts out may be removed from the classroom, further perpetuating academic deficits with the loss of instructional time. De Laet et al. (2015) found in a longitudinal study that 4th grade students who experience more teacher-student conflict were less engaged in this grade. Moreover, students who *were* more engaged in 4th grade received more support from their teacher and had less steep declines in behavioral engagement throughout 6th grade. This finding is attributed to attachment theory, in which it is presumed a child will feel more emotionally secure when they experience support and care from their teacher. This sense of security would enable students to be more apt to cope with stress, which may enhance their behavioral engagement (De Laet et al., 2015).

Cognitive Engagement in Upper Elementary School

Students who achieve more in math and reading tend to be more engaged in the classroom over time (Archambault & Dupéré, 2017; Hughes et al., 2008). Archambault and Dupéré (2017) further explain children who feel competent in a particular subject matter are likely to be more invested in the particular academic task relating to this subject matter. Successful students may perpetuate subsequent increased rates of success. As Guo et al. (2015) explain, "Children who are successful at learning tend to demonstrate better ability to follow directions, attend to instruction, and complete tasks than children who are less successful at learning" (p. 333). In a study focusing on third through fifth grade students, Skinner et al. (2016) found students with high levels of engagement used beneficial coping strategies, such as strategizing, seeking help, self-encouragement, and commitment when faced with academic difficulties.

However, Morgan et al. (2019) note by the elementary grades, academic struggles often become highly stable in subjects such as math, reading, and science. They are then at more of a

risk for social-emotional instability including feelings of anger, anxiety and, peer rejection (Morgan et al, 2019). Furthermore, students with elevated levels of disaffection are seen to use maladaptive strategies in the classroom- such as escape, confusion, self-pity, and blaming others (Skinner et al., 2016).

Emotional Engagement in Upper Elementary School

Both peer-relationships and teacher-student relationships play essential roles in emotional engagement in upper elementary school. Research shows emotional engagement supports youth to create strong emotional connections with the school (i.e., teachers, peers, student activities) (Archambault et al., 2016; Hirschfield & Gasper, 2011; Li & Lerner, 2011). A sense of belonging, commitment, and likeness to others can help students adjust and assume learning-related behaviors (Archambault et al., 2016). De Laet et al. (2015) found social acceptance from peers assists students with engaging in learning activities. However, Archambault et al. (2016) explain if elementary students feel harassed by peers, or experience conflictual relationships with peers or teachers, they are less likely to participate, are more likely to develop feelings of loneliness, anxiety, or depression, and feel a sense of detachment from their school. It is important to note emotional engagement does not remain stable but fluctuates with time (Li & Lerner, 2011). Several studies demonstrate emotional engagement tends to deteriorate as students age and ascend into higher grade levels (Archambault et al. 2016; Li & Lerner, 2011; McKinnon & Blair, 2018).

Student Engagement in Middle School

Middle school occurs between elementary and high school. In the United States, this can be 6^{th}-8^{th}, 7^{th}-8^{th}, or 7^{th}-9^{th} grade. Historically, it is a time when student engagement tends to decrease (Buhs et al., 2018). Turner et al. (2014) explain students may demonstrate more

negative attitudes, decrease effort and disengage with participation. In this sense, both behavior and academic disengagement are present (Turner et al., 2014). While disengagement may set in for some students, the importance of student engagement remains. Engagement practices are not limited to elementary learners but extend to middle school and beyond, and student engagement is a multi-level construct, compromised chiefly of behavioral, cognitive, and emotional engagement. Following is a breakdown of emotional, cognitive, and behavioral engagement in middle school (Skinner et al., 2016).

Emotional Engagement in Middle School

A great deal of engagement research surrounding middle school focuses on emotional engagement (Martin & Dowson, 2009; Reyes et al., 2012; Skinner et al., 2016). Turner et al. (2014) describe the basic human need of belonginess as a key component to emotional engagement. Peer relationships, as well as teacher-student relationships, extend to increase engagement (Turner et al., 2014; Yang et al., 2018). Teachers' ability to be relatable and show an interest in the child as an individual (e.g., asking about their weekend, music they like, and sports they play) can help to establish emotional support and feelings of connectedness. Particularly in middle school, feelings of belongingness are essential given the growth and changes that occur with puberty (Reyes et al., 2012).

Having a well-rounded social support system, including family, friends, and teachers aids in emotional engagement. Martin and Dowson (2009) reference Connell and Wellborn (1991) by stating, "in the context of a student's life, positive emotional attachments to peers, teachers, and parents promote not only healthy social, emotional, and intellectual functioning but also positive feelings of self-worth and self-esteem" (p. 330). The benefits from students feeling emotionally connected may lead to academic success (Markowitz et al., 2017; Ulmanen et al., 2016). Martin

and Dowson (2009) explain, “this fulfillment produces emotional responses and is said to drive students’ behaviors, including their responses to challenge, self-regulation, participation, and strategy use” (p.330). Emotional engagement may provide tools for students to feel secure and confident.

Cognitive Engagement in Middle School

Empirical evidence demonstrates engagement is linked to academic achievement (Buhs et al., 2018). Students willing to invest time and energy in academics achieve better outcomes (Archambault et al., 2012). It is important to note cognitive engagement does not act in isolation; rather, it may be influenced by emotional engagement. Reyes et al. (2012) explain, “Students in emotionally supportive classrooms environments also tend to choose more complex cognitive activities and perform better academically” (p. 701). Moreover, high and stable engagement correspond with better academic performance; “engagement predicts many aspects of students’ academic success, especially during the transition to middle school” (Skinner et al., 2016, p. 2100). Students who feel more competent and experienced past academic successes tend to be more engaged (Archambault et al., 2012; Turner et al., 2014).

Behavioral Engagement in Middle School

Behavioral engagement in middle school includes participation, attendance, work completion, and demonstrating non-disruptive behaviors. Orthner et al. (2013) explain students who see purpose and relevancy in what they are learning are more likely to perform well and remain engaged in the classroom. Having a clear purpose for learning content is important to creating student interest. Students will hopefully either find relevancy in classroom content for current interests or determine the learning useful for their future. Referencing Wang and Holcombe (2010), Abbott (2017) reiterates this sentiment by stating, “students who are engaged

in their education and actively seek participation in school tasks and activities are more likely to attain high academic achievement" (p. 34). Students active participation in the learning process impacts their attitude towards future engagement, such as their level of engagement in high school (Orthner et al., 2013).

Student Engagement in Primary Grades

Given that the current study focuses on student engagement in the primary grades, it is necessary to distinguish this study group from early childhood and upper elementary student engagement. For the purpose of this study, primary grades will start at the onset of elementary school and include kindergarten, first, second, and third grade students (K-3). Primary students are typically between five and eight years old.

Ample research supports the importance of student engagement in primary grades (Brouillette et al., 2014; Guo et al., 2015; Luo et al., 2009). Early grades serve as the foundation for learning and have been shown to strongly predict future success, including academic and mental health outcomes (Hughes et al., 2008; Kiuru et al., 2015; Stipek & Chiatovich, 2017). Luo et al. (2009) found both behavioral and cognitive engagement are linked to students' success in elementary school. In a longitudinal study following students from kindergarten to eighth grade, Ladd and Dinella (2009) found primary students (first and second graders) who demonstrated higher behavioral and emotional engagement made greater academic gains than students with lower levels of engagement.

Primary grades are a transitional time in a young person's life; he/she is moving away from predominantly being in the home environment to now experiencing the world of formal schooling, making the classroom an influential setting (Barghaus et al., 2017). Barghaus et al.

(2017) further explain students' interactions in early primary school set the tone for learning how to engage in the classroom setting.

Similarly, Hughes et al. (2008) recognize the importance of student engagement in the primary grades because children's early experiences in the classroom create a foundation which can lead to future schooling success.

Student engagement in the primary grades is consequently beneficial and worthy of studying. This is a pivotal time in a child's academic career and can have a future impact on their success. Yang and Lamb (2014) refer to the primary years as "the window of opportunity" in which children cultivate learning behaviors that can lead to positive academic trajectories. Hughes et al. (2008) share a similar sentiment by stating, "Children's early experiences in classrooms launch individual growth trajectories of engagement, achievement, and teacher relatedness" (p. 11).

Behavioral Engagement in Primary Grades

Behavioral engagement focuses on how students interact with peers, teachers, and content (Nguyen et. al, 2018). In kindergarten through third grade, these behaviors are often observable and categorized by on-task or off-task behaviors. This section also includes implications for teachers as classroom management and warm teacher-student relationships are discussed.

An important finding of behavioral engagement research is it can be connected to academic success (Fatou & Kubiszewski, 2018; Ladd & Dinella, 2009; Ponitz et al., 2009). Ponitz et al. (2009) found in rural kindergarten classrooms students who were more behaviorally engaged during the school year generally exhibited higher reading proficiency from fall to spring compared to those not engaged. Ponitz et al. (2009) explain strategies that contributed to this

success, including teachers enacting proactive behavioral strategies, concise explanations, and thought-provoking instruction. Hence a well-managed classroom with clear expectations may support young learners in exhibiting appropriate behaviors.

In addition to classroom management, warm teacher-student emotional interactions add to behavioral engagement (Ponitz et al., 2009). Similarly, Doumen et al. (2012) note the importance of teacher-child relationships in regard to behavioral engagement when studying kindergarten classrooms. Close teacher-child relationships revealed higher levels of behavioral engagement and conversely students with higher levels of conflict displayed less cooperative participation and lower levels of engagement (Doumen et al., 2012).

Behavioral engagement in the primary grades can consequently help shape the trajectory of a student's school experiences (Heatly et al., 2017). In a longitudinal study tracking a first grade cohort through third grade, Hughes et al. (2008) studied *effortful engagement*, or a subtype of behavioral engagement focusing on a student's involvement and persistence in not giving up on a difficult task, in relation to the quality of teacher-student relationships. Hughes et al. (2008) found, "Teacher-student relationship quality in first grade shapes children's patterns of engagement in learning, which leads both to more supportive relationships with subsequent teachers and to higher levels of achievement" (p. 11).

Also interesting to note, data reveals girls tend to be more cooperative and better behaved than boys, leading to higher levels of behavioral engagement among girls (Luo et al., 2009).

Lastly, a different finding emerged from Guo et al. (2015). Guo et al. (2015) studied behavioral engagement and reading achievement across the elementary years (data collected across multiple time points in preschool, 1st, 3rd, and 5th grade). A relation was noted between reading achievement and behavioral engagement. However, Guo et al. (2015) found reading

achievement in preschool impacted behavioral engagement in first grade, and third grade reading achievement impacted behavioral engagement in fifth grade. This finding is in opposition as many studies witness the contrary, i.e., behavioral engagement leading to future reading achievement (Heatly et al., 2008; Ladd & Dinella, 2009; Pointz et al., 2009).

Cognitive Engagement in Primary Grades

Cognitive engagement involves student self-regulation strategies, commitment to learning, persistence, and the ability to cope and actively participating in learning tasks (Fredricks et al., 2004; Lei et al, 2018; Pietarinen et al., 2014). Lei et al. (2018) conducted a meta-analysis of sixty-nine independent studies and found cognitive engagement (as well as behavioral and emotional engagement) to positively correlate with student academic achievement. Furthermore, Lei et al. (2018) explain academic success further extends student engagement, creating a cycle of learning and the notion of success breeding success. At the primary grade levels, early success in reading is connected with later reading achievements (Luo et al., 2009). Additionally, Valeski and Stipek (2001) found first graders' attitudes were impacted by their academic performance. First graders who experienced academic success felt more competent and thus enjoyed school more than students who did not perform as well (Valeski & Stipek, 2001). This also calls attention to the fact that young students can gauge their academic performance, which in turn impacts their degree of engagement in academic tasks (Valeski & Stipek, 2001).

A component of cognitive engagement, self-regulation can have an impact on current and future success. Liew et al. (2008) found in a longitudinal study that first graders who exhibited self-regulation continued positive academic self-efficacy in second grade and later supported reading (but not math) achievement in third grade. Taylor et al. (2003) found cognitive

engagement supports elementary students' growth in reading and writing. Specifically, Taylor et al. (2003) noted teachers can influence cognitive engagement through higher-order thinking questioning strategies. Students that were challenged by their teachers to think deeper in relation to what they read experienced more growth. Stipek and Chiatovich (2017) also found dialogue can promote a deeper understanding of learning. In a case study, Aguirre-Munoz and Pantoya (2016) found kindergarten students were more engaged in academic conversations when they enjoyed the learning activity. Aguirre-Munoz and Pantoya (2016) studied six female English language learners (ELLs) in kindergarten classrooms and found hands-on activities supported cognitive engagement, helping young learners maintain focus despite having a lack of background knowledge. This finding has implications for primary teachers as active exploration may support cognitive engagement. Teachers can also support cognitive engagement by establishing clear, consistent behavioral expectations. This allows more class time to be spent on academic content rather than behavioral issues (Stipek & Chiatovich, 2017).

Emotional Engagement in the Primary Grades

Relationships between students and teachers can play a key role in mediating engagement and achievement in the younger elementary grades (Hughes & Kwok, 2007; Ladd & Dinella, 2009; Kiuru et al., 2015). Students with stronger positive teacher relationships may experience more positive learning outcomes than students with negative teacher relationships (Hamre & Pianta, 2001; Kiuru et al., 2015; Valeski & Stipek, 2001).

Positive teacher-student relationships can also impact peer acceptance and peer relationships (Kiuru et al., 2015). This may be explained by a key premise of attachment theory which "focuses on the importance of close, trusting relationships in an emotionally supportive and respectful learning environment" (Stipek & Chiatovich, 2017), and repeated daily

interactions with primary attachment individuals (i.e., mothers, fathers, grandparents, and teachers) (Verschueren et al., 2012). In the classroom, attachment theory can be demonstrated when children who have heartfelt and supportive relationships with their teachers then subsequently feel safe to build positive peer relationships (Kiuru et al., 2015). Peer relationships and teacher-student relationships are an essential developmental aspect of the primary grades and can shape children's social trajectories in school (Hamre & Pianta, 2001; Verschueren et al., 2012). This is especially important as young elementary students spend a great portion of their day in school (Verschueren et al., 2012).

Teacher-student relationships can have both short and long-term influences for students. In the short term, these relationships can help children feel socially connected (Valeski & Stipek, 2001). In the long term, establishing positive teacher-student relationships in the primary grades may extend support for relationship trajectories as students age. Rudasill et al. (2011) found teacher-child relationship quality in first grade predicted teacher-child relationship quality in third grade. Similarly, Hamre and Pianta (2001) findings suggest teacher-student relationships in kindergarten are "unique predictors of academic and behavioral outcomes in early elementary school, with mediated effects through eighth grade" (p. 634). While some studies showcase the early grades having a positive effect on future engagement, Valeski and Stipek (2001) found the opposite phenomenon. In this longitudinal study, first grade students expressed more positive feelings about their relationships with their teachers than they did during kindergarten.

Engagement in Relation to Gender, Race, Cultural Values, and SES

Of particular interest in several studies revolving around engagement in the primary grades is the influence of gender, race, cultural values, and SES.

Gender

In several studies, girls tended to have closer teacher-student relationships with their educators than boys (Hughes & Kwok, 2007; Luo et al., 2009; Rudasill et al., 2011; Valeski & Stipek, 2001; Yang et al., 2018). Rudasill et al. (2011) suggest this finding may be attributed to the fact the overwhelming majority of elementary teachers in these studies were female and consequently may have experienced better rapport with their female students. Hughes and Kwok (2007) attributed this finding to boys potentially being less conforming and less self-regulated than girls.

Cultural Values and Race

In regard to cultural values and race, several studies have demonstrated student engagement may differ depending on a student's background (Hughes & Kwok, 2007; Ladd et al., 1999; Lei et al., 2018). Some studies found minority students, especially African Americans, are not as likely as Caucasian students to experience supportive relationships with their teachers (Hamre & Pianta, 2001; Hughes & Kwok, 2007; Ladd et al., 1999). Additionally, African American and Hispanic students have disproportionally higher rates of school dropout and absenteeism than Asian and Caucasian students (Brouillette et al., 2014; Gutman et al., 2002; Murray, 2009). This trend is noticeable from elementary school to college (Brouillette et al., 2014). Bae et al. (2008) state Latino students are less likely to complete high school than Caucasian and African American students. Wang and Fredricks (2014) explain the decision to drop out of high school is not spontaneous, rather "a long, cumulative process influenced by increasing levels of school disengagement and involvement in risky behaviors" (p. 773).

Conversely, Luo et al. (2009) found Hispanic elementary students displayed greater behavioral engagement, or cooperative participation and effort in learning tasks. This is believed

to be attributed to cultural values many Mexican American parents instill in their children- to work hard, be polite and respectful in class, and follow the teacher's directions (Bae et al., 2008; Luo et al., 2009).

Also dissimilar from some studies, Johnson et al. (2001) found African American middle school and high school students were more behaviorally engaged than their Hispanic and Caucasian peers.

Other researchers have found no differences in student engagement in relation to race or cultural values (Alford et al., 2016; Fattor et al., 2010). Alford et al. (2016) researched preschool through second grade public school classrooms. Their student population sample purposefully included a large percentage of Hispanic and African American students as they indicated previous classroom observation research included a large percentage of Caucasian students. Alford et al. (2016) attribute finding no distinction amongst races or cultures in student engagement to the fact that educators in this study utilized standardized instructional practices such as scripted instructions. Alford et al. (2016) contend this teacher-centered approach overlooks the range of student abilities present in early childhood classrooms. These findings are similar to Fattor's (2010) conclusions that no significant differences occurred for engagement amongst Caucasian and Hispanic ninth grade students.

Socioeconomic Status (SES)

Research regarding the impact of socioeconomic status on classroom engagement largely yields similar results with some exceptions. Elliott and Bachman's (2018) literature review highlights potential concerns with SES disparities in early academic achievement. Specifically, students with lower SES tend to start school behind their peers academically, leading to disparities in math and reading. Furthermore, these gaps in abilities may have an impact on

students' later educational outcomes. In a longitudinal study, Bodovski et al. (2013) found students with higher SES began kindergarten with greater mathematical knowledge. Over time, the growth in math achievement was greater for students with higher SES than students with lower SES.

Similarly, in a longitudinal study Greenman et al. (2011) found neighborhood disadvantages were correlated with lower math achievement at the end of fifth grade. However, the researchers also found a silver lining for families living in disadvantaged areas; When parents employ education-enhancing practices, their children's disadvantages are greatly reduced in relation to fifth grade math.

Parent- Teacher Relationships

Teacher-student relationships are typically impactful. However, parents play a major role in student engagement as well. Parent involvement is an essential component in student achievement at all ages (Gutman et al., 2002; LeFevre & Shaw, 2012; Quezada et al., 2003). In the early elementary years, parent involvement is especially important (Cheadle, 2009; Daniel et al., 2016; Meng, 2020).

Parental involvement may vary because of family backgrounds including ethnicity and socioeconomic status (Gutman et al., 2002; LeFevre & Shaw, 2012; McKown, 2013). This is believed to contribute to differing levels of student achievement (Gutman et al., 2002; McKown, 2013). Others suggest SES and cultural background are overemphasized (Daniel et al., 2016) and "has led researchers to overly deterministic conclusions concerning the relationship between social class and a student's ability to benefit from education" (Feuerstein, 2000, p. 29).

Cultural norms may therefore impact parent-teacher relationships. For example, Latino families may support their children more informally (i.e., unobserved by teachers) such as

helping with homework, making sacrifices for their children, limiting their child's chores so they can focus on homework, and discussing the importance of school with their children as opposed to more formal school participation, such as contacting their children's teachers (Auerbach et al., 2007; LeFevre & Shaw, 2012). This may be attributed to the cultural phenomenon that Latino parents value and respect the American education system and may believe contacting a teacher is impolite because it interferes or challenges the teacher's authority (Auerbach et al., 2007; LeFevre & Shaw, 2012, Quezada et al., 2003).

Additionally, the degree to which parents discipline their children can impact their schooling (McKown, 2013). Gutman et al. (2002) found, "consistent discipline and parental school involvement had positive effects on adolescents' grade point average and number of absences" (p. 391).

Findings of parent involvement impacting a child's achievement have varied in prior research (Meng, 2020). Parental school involvement with young learners can be associated with academic achievement. Hughes and Kwok (2007) found both teacher-student and parent-teacher relationships can impact student engagement and achievement with first grade students. The degree of social relatedness amongst teachers, parents, and students can positively or negatively impact students (Hughes & Kwok, 2007). Students were deemed higher achievers when stronger parent-teacher relationships were present (Hughes & Kwok, 2007). Similarly, Powell et al. (2010) found parental school involvement in preschool is positively associated with children's social behaviors and math skills. The benefits of early parent involvement in school are also apparent in Froiland et al.'s (2013) study. Findings suggest parent involvement in kindergarten helps set future academic expectations that have an indirect effect on achievement in eighth grade.

However, other studies report a lack of evidence of parent involvement connected with student achievement. In a longitudinal study Meng (2020) found first grade students with low-involvement parents achieved less mathematically, however this correlation was no longer significant at third grade. Additionally, reading achievement was not statistically significant among student with/without parent involvement.

Research

The body of research surrounding student engagement is extensive. The research discussed will be specific to my focus of instructional decisions teachers are making in order to engage students in the area of primary math. However, because the research is limited in the area of primary math, upper elementary math research will also be included. Much of the research has implications for supporting student engagement in today's early elementary classrooms.

Engagement and Math Achievement

An important finding in the reviewed research is there is a strong link between engagement and achievement (Baroody et al., 2016; Bodovski & Farkas, 2007; Luo et al., 2009). Student engagement in the early primary grades may predict children's future math growth and achievement in the later elementary grades. In two separate longitudinal studies, students with higher levels of engagement in math beginning in kindergarten and first grade outperformed their peers in terms of growth and achievement by third and fourth grade in math, respectively (Bodovski & Farkas, 2007; Luo et al., 2009).

One of these two studies was conducted by Luo et al (2009). The three-year longitudinal study involved 480 academically at-risk first graders in Texas. The purpose of the study was to assess "whether children's academic engagement types predicted their growth in math and

reading achievement" (p. 389). A cluster analysis was used to distinguish four academic engagement types. Students were sorted based on their traits and behaviors in first grade.

Based on data from the instruments, four subtypes of engagement were identified: cooperative, resistive, enthusiastic, and disaffected groups of students. The clusters represent both positive and negative traits and beliefs in regard to both behavioral and psychological engagement. Differences among the clusters were found in peer evaluations, reading, and math achievement.

Luo et al. (2009) found the cooperative group was the most popular amongst peers and included more female and Hispanic students. The enthusiastic group was the second most popular group, the disaffected group was third, and finally the resistive group was the least popular and included more male and African American students. This finding is meaningful and has implications in the classroom. Luo et al. (2009) recommend teachers specifically establish supportive relationships with students who are at risk for resistive styles of engagement. Additionally, the researchers suggest teaching temperament-based regulatory skills and providing a positive classroom climate for students.

The researchers assessed the four clusters of engagement types in relation to reading and math achievement in first grade and their growth from second to fourth grade. The results varied between reading and math. Reading achievement in first grade correlated to the different engagement groups. The cooperative group performed the best, following the enthusiastic group outperformed the resistive and disaffected groups. Surprising to the researchers, the reading growth rate from second to fourth grade was much the same across the engagement groups.

Math achievement yielded different results. In first grade there was no difference in achievement amongst the different engagement groups. However, the cooperative group

"developed at a faster rate and had higher math achievement by fourth grade than the resistive, enthusiastic, and disaffected groups" (Luo et al., 2009, p. 398). Findings reveal a connection between students' attitudes and math achievement.

Bodovski and Farkas (2007) conducted a longitudinal study examining math achievement growth from kindergarten to third grade in relation to student engagement and instructional time spent on mathematics. An additional purpose of the study was to identify whether beginning math knowledge in kindergarten impacts a student's math growth through third grade. Using a large nationally representative sample (n= 13,043 students) of U.S. students, they found students who started kindergarten with higher math performance levels had the largest achievement gains by third grade. Conversely, students who began kindergarten with the lowest levels of math knowledge exhibited the least math gains. This finding is troublesome as math learning trajectories can lead to disparity, creating an achievement gap between privileged and disadvantaged children over time.

In terms of instructional time, Bodovski and Farkas (2007) found "the time spent on mathematics instruction is positively associated with gains in achievement" (p. 126). At each survey wave, teachers reported students who initially scored the lowest received the most instructional time. Bodovski and Farkas (2007) recommended learners with math difficulties spend time daily in small intervention groups to support skill development and engagement.

Lastly, the researchers found student engagement had a larger effect on achievement than instructional time for students who initially scored the lowest on mathematics knowledge. This finding is important as it speaks to the necessity of engaging our youngest learners who may be more susceptible to disengaging with learning. Bodovski and Farkas (2007) explain, "Because these students have the lowest average engagement, techniques for fostering engagement should

be a major concern for teachers and policy makers seeking greater achievement by this at-risk group" (p. 126). Kindergarten students who began with lower achievement levels but displayed high levels of engagement displayed dramatic achievement growth in the subsequent grades. Additionally, higher-achieving students displayed greater levels of engagement at all survey waves.

In a multi-method study, Baroody et al. (2016) measured the relationship between student engagement, achievement, and social skills during math instruction in fifth grade classrooms. They found engagement during math instruction was related to math academic achievement on two of the three measures utilized. These connections were present on teacher and observer reports, but not on student-reported surveys. Engagement thus has both external and internal components. Teachers and observers determined engagement based on observations, including student behaviors and interactions. However, students may base their own level of engagement from their state of mind, including feelings, connections, level of focus, and/or social interactions.

Math Engagement and Disengagement

While investigating student engagement in relation to elementary math, a prevalent concept of math disengagement also appeared in the literature. Students may disengage from math in elementary school for several reasons. A common theme for disengaging involves experiencing math anxiety (Gunderson et al., 2018; Sorvo et al., 2017; Tomasetto et al., 2021; Vukovic et al., 2013). Gunderson et al. (2018) investigated first and second grade students' math achievement, math anxiety, and motivational frameworks in a longitudinal study. They found a reciprocal relationship of math anxiety predicting lower math achievement, whereas lower levels of anxiety predicted higher achievement.

Tomasetto et al. (2021) conducted two longitudinal studies examining math anxiety in relation to early math learning with six-year-old students in Italy and the United Kingdom. The researchers found math anxiety may reduce the ability of young children to learn novel math concepts. Math anxiety negatively impacted student performance on immediate posttests of learning new concepts. Additionally, of the four math concepts taught (two concepts for each set of participants), math anxiety interfered with two of the four concepts after a delayed post-test administered one week later. In this study, students with anxiety struggled to process new math-related content compared to their less anxious peers.

Role of the Teacher in Engagement and Instructional Decisions

While engagement and achievement have been witnessed to have a strong correlation, it is important to address the role of the teacher in relation to engagement. Teachers are charged daily with intricate decisions along with the task of delivering quality instruction (Shadden, 2018). The research reveals teachers have a great deal of influence over several aspects of engagement, including delivery of instruction, teacher-student relationship quality, and materials selection.

Delivery of Instruction

While teachers may have constraints as to what curriculum is being taught, they tend to have creative control over how they deliver instruction (Frost, 2010). In particular, teachers must decide when and how to teach content in small group or whole group contexts. In an exploratory analysis, Hollo and Hirn (2015) aimed to observe teachers' use of active instruction, engagement, and instructional groupings across elementary, middle, and high school. They found whole group instruction and independent seat work were the most common grouping amongst all grade levels. Small group instruction was most prevalent in elementary schools

(10%), compared to high school (9%) and middle school (3%). Student and teacher behaviors were examined to determine engagement and active instruction. Active engagement was found to be higher during small-group instruction than whole group instruction. During small group instruction, it was noted elementary teachers provided substantially higher rates of positive feedback and individual opportunities to respond (OTRs). As OTRs increased, active engagement also increased and passive engagement decreased. Moreover, as OTRs and active engagement increased, positive feedback increased and negative feedback decreased (Hollo & Hirn, 2015).

Similarly, in a correlational research study, Downer et al. (2007) found third grade students were more engaged in small group settings compared to large group or individualized work conditions (i.e., independent seat work). In larger groups, off-task behaviors were more prevalent. This finding has implications in the classroom as increasing engagement is often linked to increased student achievement.

However, another finding of the study is regardless of the group structure, students experiencing high-quality classroom environments were more likely to be engaged. Downer et al. (2007) define high-quality classroom environments as "hav[ing] teachers who are sensitive toward children, modify lessons and activities to fit the emotional and academic needs of the children in their classroom, establish stable routines in the classroom, monitor students carefully to keep them engaged, and manage behavior problems proactively, not reactively" (p. 427).

Instructional delivery may also encompass teacher behaviors. Teacher behaviors described in the research to increase student engagement include having positive attitudes towards math and having high expectations of students (Karp, 1991; Palardy & Rumberger, 2008; Rubie-Davies et al., 2018).

Teachers' Attitudes Towards Mathematics. In a case study conducted by Karp (1991), the researcher investigated teacher attitudes and their math instructional methods in two fourth and two sixth grade classrooms. The research revealed teachers with positive attitudes encouraged student initiative and independence, whereas those with negative attitudes used teacher-centered methods that led to passive learning. The teachers with negative attitudes focused on rote memory of algorithms with little involvement from the students. Contrarily, teachers with positive attitudes concentrated on why an algorithm works and investigated mathematical relationships. They also modeled persistent behaviors to encourage students and offered multiple opportunities for them to achieve success.

Similarly, in a longitudinal study, Palardy and Rumberger (2008) found first grade teachers' attitudes and instructional practices were more strongly associated with teacher effectiveness than teacher background qualifications (i.e., teacher certification, years of experience, advanced degrees). Teacher attitudes had a small but significant positive effect with both reading (effect size 0.21) and math (effect size 0.11) achievement gains.

Contrary to the research findings of Palardy and Rumberger (2008), Ren and Smith (2020) found primary teachers with greater mathematical knowledge (i.e., background qualifications including number of college math courses taken and certification) demonstrated more positive attitudes and beliefs towards mathematics. Their study involving three hundred ninety-six kindergarten through third grade teachers revealed higher mathematical content knowledge "is associated with more positive attitudes, lower levels of teacher-centered beliefs, and higher levels of student-centered beliefs" (p. 340). Their findings reveal depth of knowledge impacted instructional delivery.

On the other end of the spectrum, Schaeffer et al. (2020) replicated Beilock et al.'s (2010) study to examine the effects of elementary teacher's math anxiety in relation to students' mathematics achievement. Participants were exclusively female educators given the fact that the majority of elementary school teachers in the Unites States are female. Using a mediation analysis, Beilock et al. (2010) found highly math-anxious teachers negatively impacted female students' math achievement. Using a larger sample size than Beilock et al. (2010), Schaeffer et al. (2020) found a negative relation between the first-grade teacher's math anxiety and students' math achievement. Greater levels of teacher math anxiety were associated with less math learning over the course of the school year for both male and female students.

Teachers' Expectations of Students in Mathematics. Research demonstrates teachers' expectations can influence student achievement (Rubie-Davies, 2007; Rubie-Davies et al., 2018; Upadyaya & Eccles, 2014). Based on observations in primary classrooms, Rubie-Davies (2007) found a discrepancy in the classroom environment and instructional practices between teachers with high and low expectations. Teachers with high expectations provided more feedback and higher-order thinking questions, a variety of explanations to scaffold understanding, and enacted more positive behavioral management compared to low-expectation teachers.

Furthermore, in a longitudinal study conducted by Rubie-Davies et al. (2018), the researchers found teachers tend to maintain their expectations of students in both reading and math year after year, despite working with different student cohorts. Teachers were sorted into high, mid, and low expectations groups. Across three separate academic school years, the expectations of ninety-four primary and intermediate teachers were found to remain relatively stable amongst all three groups.

In a cross-sectional study, Trang and Hansen (2021) found high expectations improved teacher-student relationships with kindergarten and first grade students. Higher teacher expectations correlated with less teacher-student conflict.

In a longitudinal study Upadyaya and Eccles (2014) concluded when elementary teachers held high expectations for future achievement, students' math performances were also high. Teacher expectations were positively associated with students' effort, interest and abilities in math.

A pitfall of teacher expectations demonstrated in the research is it may not be balanced amongst ethnicity and gender (McKown & Weinstein, 2008; Riegle-Crumb & Humphries, 2012; Rubie-Davies et al., 2006; Trang & Hansen, 2021). The research reveals mixed results regarding teachers' expectations in connection with students' identities. Van den Bergh et al. (2010) conducted a study in the Netherlands and found teacher expectations were significantly lower for Moroccan and Turkish elementary students compared to Dutch peers. McKown and Weinstein (2008) found classrooms with the greatest amount of diversity also had the highest differential teacher treatment and greater bias in teacher expectations. Teachers ranked European American and Asian American students higher in reading and math achievement than similarly achieving African American and Latino students. Rubie-Davies et al. (2006) found teacher expectations were high for all ethnic groups (i.e., New Zealand European, Pacific Island, Asian) except Maori. There were no statistically significant differences between teacher judgements and reading achievement, thus teacher expectations were found to be accurate.

In regard to gender, Riegle-Crumb and Humphries (2012) used data from a longitudinal study and found high school teachers were more likely to conclude white female students as being in too difficult math classes compared to white males. However, this finding was not

similar when judging Black females to white males. Teachers therefore perceived math being easier for white males than white females. On the other hand, McKown and Weinstein (2008) did not find gender differences with teacher expectations.

Teacher-Student Relationship Quality

A prevalent research topic is teacher-student relationship quality (TSRQ) and its impact in the classroom. Several studies have shown TSRQ to impact student engagement and student achievement in elementary school (Blazar and Kraft, 2017; Martin & Rimm-Kaufman, 2015; Wu, 2010).

In a longitudinal study following 5th grade math students (n=387), Martin and Rimm-Kaufman (2015) found high quality teacher-student interactions supported student engagement and compensated for students' low math self-efficacy. Martin and Rimm-Kaufman (2015) reference Schunk and Pajares (2005) in defining self-efficacy as, "an individual's perception of his or her capacity to learn or perform a task in a given domain" (p. 360). Students with high self-efficacy were observed to be engaged regardless of the classroom environment. However, students with low levels of self-efficacy benefited from an emotionally supportive environment. Students with low self-efficacy were witnessed to have higher levels of engagement with increased teacher support.

In 2017, Blazar and Kraft conducted a longitudinal study examining whether aspects of teaching practices predict students' attitudes and behaviors in fourth and fifth grade math classes. They found teachers' emotional support is significantly correlated with students' self-efficacy in math and satisfaction in class. An increase in teacher's emotional support is associated with an increase in both of these student constructs.

Offering a different view, Stuhlman and Pianta (2009) profiled four different types of first grade classrooms in a longitudinal study. Observational data were collected from 820 first-grade classrooms in 32 states that were part of the National Institute for Child Health and Human Development's Study of Early Child Care and Youth Development (NICHD SECCYD).
The four profiles were based on teacher behaviors and classroom characteristics. These profiles consisted of 'positive emotional climate, lower academic demand' (31%), 'overall high quality' (23%), 'mediocre' (28%), and 'overall low quality' (17%). They found classroom teachers in the 'positive emotional climate, lower academic demand' group could be emotionally supportive (i.e., positive/sensitive classroom climate, manages classroom well so uninterrupted learning can take place) but did not provide evaluative feedback to students. While these classrooms were positive in nature, they "did not tend to promote children's engagement in learning by giving them feedback that focused on mastery, developing understanding, or trying new strategies" (Stuhlman & Pianta, 2009, p. 333).

More recently, in a longitudinal study, Hajovsky et al. (2020) explored teacher's personal self-efficacy as it relates to TSRQ and contributes to math achievement from third to sixth grade. Teacher self-efficacy refers to a "teachers' individual beliefs about their own abilities to successfully perform specific teaching and learning related tasks within the context of their own classroom" (Dellinger et al., 2008, p. 751). Two characteristics of TSRQ are *closeness* and *conflict*. Closeness signifies warm, positive teacher-student relationships. Conflict denotes negative teacher-student interactions and a lack of rapport. In their study both closeness and conflict predicted teacher self-efficacy which subsequently aligned to math achievement in third and fifth grade. They found conflict had a direct effect on math achievement whereas closeness had an indirect effect on math achievement through teacher self-efficacy. Hajovsky et al. (2020)

further explain teacher self-efficacy may relate to student engagement. Higher levels of teacher self-efficacy are associated to more engaged students.

Materials Selection

Teachers may be confined to teaching specific state standards, using a certain textbook program, or following a curriculum map (Cooper, 2009; Remillard, 2005). However, they may have creative control over how to implement such lessons or which materials to use to best engage students. Research demonstrates materials selection can facilitate student engagement in the elementary grades. Materials selection may include, but are not limited to, game-based learning, manipulatives, and physically active lessons.

Game-based Learning. In an action research study, White and McCoy (2019) found game-based learning improved fifth grade students' achievement and attitudes towards math. Interviews with students revealed they enjoyed working collaboratively with their peers, and the games increased student engagement. Similarly, a semi-experimental study was conducted by Partovi and Razavi (2019) comparing computer game-based learning to conventional teaching methods with first grade students. The researchers determined the computer game-based learning program increased students' academic achievement motivation. Conducting a systematic review, Vankúš (2021) assessed 57 articles relating to game-based learning and mathematics. The researcher reported 84% of the articles found positive influences of game-based learning on students (i.e., positive effects on student motivation, engagement, attitudes, enjoyment, state of flow, and attention). The other 16% of the articles reported mixed results of game-based learning in relation to math (i.e., relating to student attitudes, motivation, and anxiety).

Manipulatives. In order to provide students with a hands-on experience, teachers may opt to use manipulatives as part of their mathematics instruction (Uribe-Flórez & Wilkins, 2017).

Manipulatives refer to "objects designed to represent explicitly and concretely mathematical ideas that are abstract. They have both visual and tactile appeal and can be manipulated by learners through hands-on experiences" (Moyer, 2001, p. 176). Drawing from fifty-five studies, Carbonneau et al. (2013) conducted a meta-analysis to determine the effectiveness of manipulatives compared to instruction using only abstract math symbols. The researchers found using manipulatives created a small- to medium-sized effect on student learning compared to instruction with abstract symbols solely. Additionally, the use of manipulatives was positively associated with retention, problem-solving, transfer, and justification.

Osana et al. (2017) used a pre-test–intervention–post-test experimental design to examine second graders' learning of place value and regrouping with manipulatives. The researchers assessed two aspects, (a) the sequence of using manipulatives (e.g., base ten blocks) or abstract concepts (e.g., standard algorithms) first to better understand place value and (b) the extent to which instructional guidance played in learning. To the researchers' surprise, they found manipulatives increased place value knowledge but only when no instructional guidance was offered. Instructional guidance however was beneficial in the abstract concepts first condition. Additionally, regardless of the instructional sequence, students improved their regrouping understanding from the pre to the post assessment.

Uribe-Flórez and Wilkins (2017) conducted a study that utilized two approaches. Using a cross-section correlation analysis, they found no statistically significant relationship between student math achievement and the use of manipulatives in each grade level (i.e., kindergarten, first, third, and fifth grade). However, the researchers' longitudinal study (kindergarten-fifth grade) revealed a positive relationship between the use of manipulatives and student learning. Students were categorized by how often they used manipulatives in a month's time (i.e., hardly

ever, two to eight times, and almost daily). Students that used manipulatives daily had an increased rate of learning compared to the students who used manipulatives two to eight times a month. Moreover, the students that used manipulatives two to eight times a month had an overall increased learning rate compared to the group of students that rarely used manipulatives.

Physically Active Lessons. Snyder et al. (2017) aimed to study the effects of purposeful movement by comparing two third grade classes (one acting as the experimental group and the other as the control group). In the experimental class, the teacher worked with the school's physical education teacher to create active lessons for a five-week math unit. The lessons were designed to include physical movement for at least half of the seventy-minute daily lessons. Findings reveal the experimental group had significantly higher rates of active engaged time and significantly lower rates of off-task passive behavior compared to the control group. All students in the experimental group also expressed positive responses to the activities. When reviewing post scores for the math unit, both classes scored comparably. The researchers explain the lack of achievement differences confirms movement does not distract from quality learning.

Bartholomew et al. (2018) conducted a study employing a large, cluster randomized control trial in which fourth grade students were assessed on student attention and time on task following a physical activity. Students were randomly assigned either the (a) control group (i.e., traditional, sedentary lessons), (b) intervention language arts, or (c) intervention math. Results reveals students in the intervention groups spent significantly more time on task compared to the control group. Furthermore, a higher dose of physical activity was connected to increased time on task during the intervention conditions.

Dyrstad et al. (2018) utilized a 10-month cluster randomized control trial to examine a teaching method of combining physical activity with academic content in fifth grade classrooms.

The intervention teachers were tasked with implementing two forty-five minute physically active lessons per week (primarily performed outdoors), one ten-minute teacher-directed physically active recess per day, and assigning a ten-minute physically active homework assignment daily. Teachers conducting the intervention were also asked to complete a weekly log documenting the assigned tasks. The researchers were then interested in collecting data on the responses to physically active academic lessons from the perspective of school leaders (principal or vice principals), teachers, and students. Furthermore, the researchers wanted to ascertain the facilitators and barriers to these lessons. Interviews with school leaders, teachers, students predominantly shared a positive opinion of the physically active academic lessons. Several teachers explained the lessons were pedagogically appropriate for learning new content as well as reviewing and motivating for students. The interviewed teachers expressed interest in continuing to incorporate physical movement in lessons but wanted them to be less frequent and shorter in duration (around fifteen to twenty minutes). A limitation of this study is the program was not necessarily met with fidelity by all six intervention schools. Of the 34 weeks, teacher logs reporting their physically active lessons were turned in 53% of the time. Barriers of physically active lessons include teachers had a lack of planning time and found it difficult to create quality and varied lessons. Likewise, interviewed students reported enjoying the physically active lessons unless it became boring and monotonous over time (i.e., doing the same lesson repeatedly).

Seminal Research

The research regarding student engagement is vast. Student engagement has been extensively studied for decades. Research encompasses a large spectrum of student ages, participant backgrounds, geographical locations, and academic and non-academic aspects of the

school day. Most notably, the work from four seminal studies standout as the research remains prevalent today and is often cited by others in the field. These seminal studies include Fredricks et al. (2004), Skinner and Belmont (1993), Hamre and Pianta (2001), and Klem and Connell (2004) and were considered seminal status due to widespread recurrent citing by thousands of professionals in the field.

Fredricks et al. (2004)'s review discussed several definitions, measures, precursors, and outcomes of student engagement. Chiefly, they created a widely accepted definition of student engagement that is prevalently used today. Their definition views student engagement as a multidimensional construct that connects three key components, (a) behavioral engagement, (b) cognitive engagement, and (c) emotional engagement. The three components are defined as:

> *Behavioral engagement* draws on the idea of participation; it includes involvement in academic and social or extracurricular activities and is considered crucial for achieving positive academic outcomes and preventing dropping out. *Emotional engagement* encompasses positive and negative reactions to teachers, classmates, academics, and school and is presumed to create ties to an institution and influence willingness to do the work. Finally, *cognitive engagement* draws on the idea of investment; it incorporates thoughtfulness and willingness to exert the effort necessary to comprehend complex ideas and master difficult skills. (p. 60)

Further, the researchers explain these types of engagement are not mutually exclusive but at times do overlap with one another.

A prominent researcher in the student engagement field, Skinner has contributed with her work regarding engagement and motivation. Skinner and Belmont (1993) are commonly referenced in the student engagement research for their study regarding teacher behaviors and its

effects on third, fourth, and fifth grade students' behavioral and emotional engagement. The researchers studied three aspects of teachers' behavior including (a) involvement, (b) structure, and (c) autonomy support. Involvement refers to teacher-student relationship quality. Teachers may genuinely put forth effort to know their students, enjoy interacting with them, and express a warm relationship. *Structure* refers to teachers explicitly communicating expectations, being consistent and predictable, and altering teaching styles to meet the needs of learners. *Autonomy support* refers to the degree of independence a child is given to regulate his or her own behavior. Teachers may encourage autonomy support by incorporating student choice or student interests, which hopefully inspires intrinsic motivation within students.

Skinner and Belmont (1993) found a reciprocal relationship exists between three aspects of teachers' behaviors and student engagement. Specifically, teachers' interactions were found to predict both students' behavioral and emotional engagement. Involvement was witnessed to have the strongest effect on students' perceptions of their teachers. The study explains teachers tend to convey their affection for students through interactions. On the contrary, students who perceived their teachers to lack involvement also tended to view them as more coercive and inconsistent. Additionally, favorable or positive student engagement evokes lasting positive teacher behaviors. Students who demonstrated high behavioral engagement in the Fall subsequently received more support from teachers in the Spring.

Another seminal study commonly referred to in student engagement research is Hamre and Pianta's (2001) longitudinal study. The purpose of this study was to analyze the degree to which kindergarten teacher-student relationships are associated with students' academic and behavioral outcomes through eighth grade. Outcomes involve reading and math grades, standardized test scores, work habits, and disciplinary records. Following a sample of one

hundred seventy-nine children, the researchers found a correlation between teacher-student relationships, as described by kindergarten teachers, and both academic and behavioral outcomes in early elementary school (kindergarten-fourth grade), with mediated effects through eighth grade. Teachers' reports of negative relationships with students predicted academic grades, standardized test scores, and work habits through fourth grade. Relational negativity, a combination of conflict and dependency, predicted behavioral outcomes through eighth grade but not academic outcomes.

Additionally, kindergarten teachers reported more positive and closer relationships with female students than male students. In lower elementary grades females and males tended to have similar test scores yet females consistently had higher academic grades and received higher marks for positive work-habits. In upper elementary and middle school, these differences between the genders were not significant. However, male students rated as having more conflict with kindergarten teachers were witnessed to have lower math and reading grades in lower elementary, upper elementary, and middle school. Males rated as being more dependent in kindergarten received fewer positive work-habit marks in lower elementary and perpetuated behavioral challenges in upper elementary and middle schools by having higher rates of disciplinary issues. Unlike their male peers, females rated as having higher dependency in kindergarten were not significantly related to later negative behavioral outcomes.

Lastly, Klem and Connell (2004)'s work is referenced regularly in the student engagement field. The researchers studied student engagement and achievement in relation to teacher support at the elementary and middle school grades. Student records and survey data were collected from both teachers and students. The data collected sorted students between optimal or at-risk levels of engagement.

According to the student reports, 35% of elementary and 31% of middle school students were at risk of disengagement in school. Research demonstrates disengagement adversely impacts student performance and commitment. 27% of elementary students and only 14% of middle school students scored optimally in regard to engagement.

According to the teacher reports, 40% of elementary and 17% of middle school students were at-risk. Teachers also reported 22% of elementary and 19% of middle school students scored in an optimal range. The discrepancy between students and teachers' ratings are attributed to the fact that teachers rated behaviors students demonstrated and students reported about their behaviors and emotions.

Both elementary and middle school students with high levels of engagement were more likely to achieve greater academically and have better attendance. Additionally, teacher support was reported to increase student engagement and decrease feelings of disengagement. On the contrary, students with lower levels of teacher support were more likely to disengage from school.

While the researchers explain their findings are very much aligned to past research, their approach to utilizing a threshold analysis for optimal and risk levels for student success is unique. A threshold analysis gives information for policymakers and stakeholders to create interventions and set targets for improving student outcomes.

Conclusion

The literature surrounding student engagement is wide-ranging and generally recognizes engagement having positive effects in the classroom at all ages. The existing research acknowledges several definitions for student engagement withstand (Fredricks et al., 2004; Hirschfield & Gasper, 2011; Lester, 2013; Parsons & Taylor, 2011) and may overlap with one

another. However, Fredricks et al. (2004) definition outlining engagement as a multidimensional construct including behavioral, cognitive, and emotional engagement is currently the most prevalent.

The review of literature has indicated engagement may be linked to higher academic achievement, preventing early dropout from high school, and can shape the trajectory of a student's schooling career (Baroody et al., 2016; Bodovski & Farkas, 2007; Luo et al., 2009; Wang & Fredricks, 2014).

A great deal of student engagement research focuses on upper elementary, middle, and high school, yet primary elementary student engagement is considerably less studied. However, primary grades student engagement research is necessary as research indicates lower elementary grades set a foundation for learning and early engagement may have a lasting impact for years to come (Hughes et al., 2008; Kiuru et al., 2015; Stipek & Chiatovich, 2017).

Specifically, primary math student engagement may be influenced by teachers' instructional decisions. The research reveals teachers' instructional decisions to enhance student engagement include, but are not limited to, incorporating positive and consistent delivery of instruction (Downer et al., 2007; Karp, 1991; Palardy & Rumberger, 2008; Rubie-Davies et al., 2018), maintaining warm teacher-student relationships (Blazar and Kraft, 2017; Martin & Rimm-Kaufman, 2015; Wu, 2010), and selecting enjoyable learning materials (Osana et al., 2017; Snyder et al., 2017; White & McCoy, 2019).

CHAPTER 3

METHODOLOGY

This chapter presents the research design of this study. In more detail, it provides the purpose of the study, restatement of the research questions, research design, research methods, sample selection, data collection methods, and data analysis procedures.

Purpose of the Study

The purpose of this study was to explore the instructional decisions primary teachers make to better engage students in math. The phenomenon of teachers altering, supplementing, or utilizing district-given materials to support student engagement and understanding was studied. In simpler terms, the study involved determining the difference between what resources teachers at a specific school are *given* and what they are *using*. The research was intended to be descriptive in nature in an effort to understand what engagement strategies teachers were implementing in the classroom. A case study approach to discern these practices was employed in order to study the natural environment of teachers' daily instructional decisions pertaining to engagement.

Restatement of the Research Questions

1.) What instructional decisions are exemplary teachers making to engage students in the area of primary math?
    a. How do primary teachers define student engagement?
2.) What changes, if any, to district-provided instructional materials are exemplary teachers making with the intention to enhance student engagement in primary math?

Research Design

Methodology

A great deal of student engagement research employs positivist methodologies and methods to quantify achievement in relation to student engagement. Researchers have quantified aspects of engagement such as dropout rates, student attendance, grades and standardized testing achievement, SES impact, and teacher and peer relationships. Positivist research is concerned with objectivity and establishing meaning operationally (Patton, 2002). Merriam and Tisdell (2016) state, "A positivist orientation assumes that reality exists "out there" and that it is observable, stable, and measurable" (p.9). Positivist methods may include experimental, survey, or quasi-experimental designs (Merriam & Tisdell, 2016). From the literature review, a good portion of positivist research studies utilized a longitudinal method.

A lesser amount of studies concerning student engagement have utilized a case study approach. Even fewer case studies involve researching student engagement in the primary grades. Creswell (2013) explains,

> Case study research is a qualitative approach in which the investigator explores a real-life, contemporary bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information (e.g., observations, interviews, audiovisual material, and documents and reports), and reports a case description and case themes. (p. 97)

There is not a clear consensus amongst researchers as to whether or not case study is a methodology. Stake (2005) states, "case study is not a methodological choice but a choice of what is to be studied" (p. 443). Yet, Creswell (2013), Flyvberg (2011), Merriam and Tisdell (2016), and Yin (1994) consider case study to be a methodology. Creswell justifies it is "a type

of design in qualitative research that may be an object of the study, as well as a product of the inquiry" (p. 97). For the purpose of this study, case study was considered a methodology.

Drawing on a qualitative research framework, the selected methodology for this study was case study. Merriam and Tisdell (2016) note case studies can include both qualitative and quantitative methods, or a mixed-methods design. The researcher solely collected qualitative data in this study.

Case study researchers can choose to study single or multiple cases. Singular case studies involve studying *one* particular program or *one* particular bounded system (Merriam & Tisdell, 2016). Singular case studies may have subunits or subcases embedded (Merriam & Tisdell, 2016). In contrast, multiple case studies, also referred to as multi-case or comparative case studies involve collecting and analyzing data from several cases (Creswell, 2013; Merriam & Tisdell, 2016; Yin, 2003). This study utilized a singular case study design.

Determining the participants and site for this study was one of the fundamental methodological decisions for selecting a case study approach (Saeed & Zyngier, 2012). This study was bound by its' participants (exemplary primary general education teachers who teach math) and place (two public school districts in the American Southwest). The purpose of this study was to explore and gain an in-depth understanding of the participants' experiences relating to student engagement instructional decisions in primary math. This was a multisite case study as three different schools within two school districts were included in the study. Five teachers participated in this study. The small sample size was helpful in allowing the researcher to describe their experiences promoting student engagement and present common themes.

This case study was situated within an interpretative paradigm. The nature of this paradigm is to understand, describe, and interpret (Lukenchuk et al., 2013; Merriam & Tisdell,

2016). Interpretivism accepts multiple realities and acknowledges individuals interpret a single event with different perspectives (Merriam & Tisdell, 2016).

Prior to selecting case study as the methodology, other approaches were considered. Similar to case study, phenomenology also focuses on understanding and describing (Creswell, 2013). Phenomenology focuses on studying individuals who have shared the experience or phenomenon, whereas case study is interested in "studying an event, a program, [or] an activity" (Creswell, 2013, p. 104). Both approaches utilize conducting interviews for collecting data. However, the questions and research purpose differ. Phenomenology is therefore not a fit for this study as the participants' experiences with instructional decisions surrounding student engagement in math may be different. The focus of this study is not a shared phenomenon.

Narrative research was not selected because it deals with exploring life events of participants (Creswell, 2013). While this approach reports individual experiences, its emphasis is on collecting stories of lived and told experiences from participants (Creswell, 2013; Merriam & Tisdell, 2016). Narrative studies are often articulated in chronological order, which does not apply to this study (Creswell, 2013).

Case study was considered the best fit for the study as it aligned with the purpose of the research. The researcher aimed to gain a deeper understanding of the instructional decisions primary teachers made to promote student engagement in math.

Bracketing Interview

Prior to conducting the study, a bracketing interview took place. The purpose of a bracketing interview was to address prior beliefs and biases, reflect on such notions, and ultimately to suspend beliefs in order to perceive the research phenomenon more clearly (Creswell, 2013; LeVasseur, 2003; Merriam & Tisdell, 2016). Fischer (2009) explains,

> In short, bracketing is not a setting aside that one maintains until the completion of data analysis and before one reflects on the implications of one's findings. It is a mindfulness that one brings to bear regularly, asking about assumptions that have gone into what one saw and into how one has ''languaged'' what was apprehended. (p. 584)

The bracketing interview served as a means to acknowledge and identify biases the researcher held. The researcher was interviewed by a college of education university professor that was knowledgeable of bracket interviewing. The interviewer formulated questions around the research topic. The interview took place via Zoom.

Research Methods

Research methods for this study included the use of interviews. As a means to elicit an in-depth understanding, interviews were conducted. Yin (2009) states "interviews are essential sources of case study information" (p. 84). Merriam and Tisdell (2016) and Patton (2002) explain we interview people to uncover what is not directly observable, such as feelings, thoughts, intentions, or how one organizes and creates meaning of the world. Interviews thus allow for other's perspectives to come to light.

There are different types of interviews that serve a variety of purposes. Interviews are commonly categorized by the degree of structure. Three types of interviews include highly structured/standardized, semistructured, and unstructured/informal interviews (Merriam & Tisdell, 2016). Structured/standardized interviews are useful for gathering demographic data such as age, gender, and ethnicity. In this format, questions and the sequencing of questions are predetermined (Merriam & Tisdell, 2016). Semistructured interviews fall in the middle of the three approaches. They may include both structured and unstructured questions, or the questions may be more flexibility worded (Merriam & Tisdell, 2016). Lastly, unstructured interviews are

more conversational in nature and rely on spontaneity instead of predetermined questions (Merriam & Tisdell, 2016; Patton, 2002).

The best fit for this study were semi-structured interviews. This method allowed for participants to respond to open-ended questions that were focused on understanding the essential phenomenon of the study (Creswell, 2013). The interview was guided by a list of questions to be explored (Merriam & Tisdell, 2016). This format allowed the researcher to determine questions ahead of time yet created flexibility to ensure all relevant topics were covered (Merriam & Tisdell, 2016; Patton, 2002). (See Appendix E for the interview protocol.) Additionally, individual interviews (as opposed to focus group interviews) took place. This format was believed to elicit more authentic responses.

Interview questions ranged amongst Patton's (2002) six types of questions: (1) experience and behavior questions, (2) opinion and values questions, (3) feeling questions, (4) knowledge questions, (5) sensory questions, and (6) background/ demographic questions. Patton (2002) recommends opening interviews with easy questions that elicit more descriptions from the interviewee. Once experiences are described, other question types such as feelings or opinions in connection with the shared information can take place. Probes were included in the interview protocol as a means to follow-up on something already asked (Merriam & Tisdell, 2016). This helped to gather more details or clarification (Merriam & Tisdell, 2016).

At the beginning of the study and prior to conducting interviews, a questionnaire was sent to participants via email. Included was a link in the email to complete this questionnaire electronically via Qualtrics. The purpose of the questionnaire was to collect background information (i.e., number of years taught, grade levels taught, level of education attainment and certification, and school demographics). Additionally, some questions pertained to the study's

criteria to ensure participants were eligible to participate (i.e., currently a primary teacher, teaches math, and has some amount of creative control to select math materials). The responses from the questionnaires were consequently integrated in the findings of the study. A copy of the questionnaire is in Appendix D.

Sample Selection

The participants in this study included primary teachers (i.e., teachers that taught either kindergarten, first, second, or third grade). The teachers also taught math daily. Additionally, participants were deemed as 'exemplary' in regard to student engagement practices according to annual teacher evaluations. Lastly, teachers at the selected schools had to have some flexibility to choose appropriate math learning materials.

It was hoped the study would involve five to eight participants. After eleven months of recruitment, the study involved five participants. Lincoln and Guba (1985) recommend the sample size be set by informational considerations, "If the purpose is to maximize information, then sampling is terminated when no new information is forthcoming from newly sampled units; thus *redundancy* is the primary criterion" (p. 202).

The study utilized purposeful sampling, or selected participants "that can purposefully inform an understanding of the research problem and central phenomenon of the study" (Creswell, 2013, p. 156). The individuals selected were therefore 'information rich' and offered an in-depth understanding of the problem (Patton, 2002; Pickard & Childs, 2013).

The sample population was obtained from two public school districts in the American Southwest. The school districts had to be public and have an adopted math program to be able to participate in this study. To best illustrate the process of recruiting participants and collecting data, Table 1 displays the timeline of research.

Table 1

Timeline of Research- Recruitment and Data Collection

Timeline of Research- Recruitment and Data Collection	
Date	Task
November 2021	Prospectus defense
December 2021	Submitted documents to NAU's IRB
February 2022	Received approval from NAU's IRB, began requesting approval to conduct research with school districts
April 2022	Received approval from school district #1 to conduct research Recruited participants and collected data However, did not hit mark of recruiting 5-8 participants and did not have any leads to move forward
May 2022	Received approval from school district #2 to conduct research and began recruitment process No principals responded to initial request Summer break commenced
August 2022	Second attempt at recruiting participants at school district #2 upon staff returning to schools No principals responded to request
September 2022	Received approval from school district #3 to conduct research and began recruitment process
January 2023	Finished data collection

Gaining approval from school districts proved to be a lengthy process. Due to COVID-19, school districts were often not accepting requests to conduct research. Additionally, some school districts were only approving research studies for their own employees. In total, the researcher contacted and requested to conduct research with ten different school districts (see Appendix C).

Initially, one school district approved the researcher's request to conduct research. The researcher anticipated working only with this one school district. However, due to insufficient number of participants, the researcher added a second school district to recruit participants. An amendment to the study was made to include a second school district (see Appendix A).

A second school district approved the researcher's request to conduct the study with their teachers. The researcher was not successful in recruiting participants at this second school district. Principals did not nominate teachers to participate. This may have been due to the timing of the researcher's recruitment process. The recruitment process occurred with only two weeks remaining in the school year. Another attempt at recruitment occurred at the beginning of the following school year, however this effort was also unsuccessful. Again, principals did not nominate teachers to participate.

The researcher thus moved on to gaining approval from a third school district. A different school district agreed to participate in the study. An amendment to the university's IRB (Institutional Review Board) was made to substitute the second school district for the third school district (see Appendix A). The recruitment process was able to be carried out successfully within this third school district.

Upon Institutional Review Board (IRB) approval and permission from the participating school districts, the researcher recruited participants by emailing elementary school principals information regarding the purpose of the study and protocols (see Appendix C). In the email, the researcher asked principals to nominate three potential participants the researcher could contact regarding participation. Follow-up phone calls and emails to principals were made as necessary. This strategy for recruiting participants is suggested by Merriam and Tisdell (2016), "begin with

a key person who is considered knowledgeable by others and then ask that person for referrals" (p. 127).

From the teacher nomination form completed by principals, one teacher was randomly selected from the list to be contacted. If the teacher contacted did not wish to participate, a second teacher was randomly selected from the list. If the second teacher contacted also did not wish to participate, the third teacher from the list was contacted. If all three teachers declined participation, the researcher contacted different principals and teachers.

At one school, the researcher contacted both a principal and a senior figure. The senior figure acted on behalf of the principal to nominate teachers. The principal signed off that the researcher had permission to conduct research at this school.

Additionally, acting on a recommendation from a school district administrator, the researcher added snowball sampling to increase participation. An amendment was submitted and approved by IRB (see Appendix A). Snowball sampling involved asking participating teachers if they knew a colleague within their school district that met the requirements and would be interested in participating. Snowball sampling proved to be beneficial as one teacher agreed to participate through these means.

Nominated teachers were emailed study information, the informed consent document, and the questionnaire (see Appendix B, C, and D). Potential participants were asked to complete the informed consent document and the questionnaire via Qualtrics.

Teachers either completed the informed consent document and questionnaire on Qualtrics or emailed the documents signed and completed. Responses from the questionnaire were used to determine potential participant's eligibility to participate.

Five teachers participated in this study. The participants taught at three different schools within two school districts. The teachers taught either kindergarten, second grade, or third grade. Background information regarding the participants is embedded within chapter 4. Working with teachers from different school sites helped to illuminate multiple perspectives (Creswell, 2013).

Using criterion sampling, all participants in the study met certain guidelines to be considered for participation (Creswell, 2013). The criteria for participation included requirements for both the selected school districts and the participants. The school district criteria involved (a) a public school district and (b) the district had to have adopted a math textbook program. The participant requirements included (a) the participant must be a general education kindergarten, first, second, or third grade teacher, (b) taught mathematics, (c) deemed an exemplary teacher by receiving high ratings on annual teacher evaluation form in the area of student engagement practices, and (d) have some amount of creative control for selecting appropriate teaching resources to best fit the needs of their students.

Participants, Consent, and Confidentiality

A proposal outlining this research study was submitted to Northern Arizona University's IRB for approval to work with human subjects (see Appendix A). Additionally, permission from the participating school districts was obtained. School districts gave their approval to contact principals and teachers. One school district also required the researcher to have permission forms signed from principals to contact teachers. This was accomplished.

Signed informed consent documents (see Appendix B) were obtained from the teacher participants. A copy of the informed consent document was emailed to teachers. A link was also embedded in this email to sign the informed consent document via Qualtrics electronically.

In addition to the informed consent document, teacher participants were also sent a questionnaire in the same email. The questionnaire asked teachers to share their background information, school's demographics, and answer questions to ensure they met the study's participation criteria (see Appendix C). Similar to the informed consent document, they were asked to electronically complete the questionnaire via Qualtrics.

Verbal consent was obtained prior to conducting interviews and video-recording. Participants were given assurance of ethical principles, such as anonymity and confidentiality.

Procedures to ensure confidentiality were in place. The participating school district, schools, principals, teachers, and adopted math program(s) were protected by not using names in transcript drafts (i.e., Participant A, Participant B, Participant C, etc.) and pseudonyms were used when reporting results in the final document.

Transcripts were provided to participants for review. Participants had the opportunity to read their own transcript draft for approval. Participants were given control to add, modify, or keep their transcripts the same. Once teachers reviewed their transcripts, they emailed the researcher that it was approved.

Coding data were stored securely using a password-protected program (Qualtrics and OneDrive) on a password-protected computer. Video-recordings were saved on a password-protected computer. Recordings were used only for the purpose of transcribing. Recordings were deleted after the end of the study. Additionally, interview transcripts, questionnaires, and teacher nomination forms were deleted after the end of the study.

Paper materials were stored in a locked filing cabinet during the study. Paper materials were shredded at the end of the study.

In accordance with Northern Arizona University's data management policy, the informed consent forms will be stored for five years.

Data Collection

The methods used to collect data involved an open-ended questionnaire and interviews. Both the questionnaire and interview were pilot tested.

Prior to formal data collection with participants, a pilot study was conducted with three colleagues that matched the description for the participation criteria. The purpose of pilot study was to refine the interview questions and procedures (Creswell, 2013; Yin, 2018). The subjects were sent the recruitment email, informed consent document, and questionnaire. Each subject completed the documents and also participated in a mock interview.

The colleagues gave their feedback regarding the study's protocols. The researcher then refined the data collection process based on feedback from the pilot testing. Changes included making the directions clearer and more concise.

Participants for this study were selected from two school districts upon IRB approval and permission from said school districts. Using purposeful sampling, the researcher emailed elementary school principals within the two districts to explain the purpose of the study and invited them to nominate three primary teachers that demonstrated exemplary math student engagement strategies and would be potentially willing to participate. A single teacher at random from this nomination form was emailed a recruitment letter and given the informed consent document and questionnaire. If this teacher did not wish to participate, a second teacher was selected at random. If the second teacher selected also chose not to participate, the third teacher was contacted. If all three teachers declined participation, the researcher requested participation from different principals and teachers.

As necessary, the researcher followed-up with principals and teachers to address questions or provided additional information. Building trust and establishing rapport with principals and teachers was necessary.

A thank you note was sent to each participating principal, regardless of whether teachers at the school chose to participate. A thank you note and Starbucks gift card ($10 value) was sent to each participating teacher.

The sample size for this study included five participants. It was hoped data collection would involve a minimum of five and a maximum of eight participants. Due to time constraints and the effort to recruit participants for eleven months, the minimum total of participants was met. Ideally, data collection should be based on saturation (Creswell, 2013; Merriam & Tisdell, 2016). Merriam and Tisdell (2016) explain, "saturation occurs when continued data collection produces no new information or insights into the phenomenon you are studying" (p. 199). However, with a small sample size, this was a limitation of the study.

A range of five to eight participants was included in the study as it may have been possible not all initial participants would complete the study. Hence, it was helpful to include a range of participants as unforeseeable circumstances may occur. Five teachers completed all the participation requirements. However, two additional teachers originally agreed to participate but had a change of heart due to time constraints.

Data were collected in the form of questionnaires and interviews. The questionnaire collected pertinent background information (i.e., teaching qualifications, number of years taught, grades taught, etc.) and also information regarding school demographics. The questionnaire also included questions relating to the criteria of the study (i.e., currently teaching a primary grade, teaches math, received 'exemplary' rating on annual teacher evaluation, and has some creative

control to select math materials). Criteria questions ensured participants met the qualifications to continue with the study.

Upon signing the informed consent document and successful completion of the questionnaire (i.e., the participants fit the study's criteria), teachers were contacted via email to schedule an interview. Interviews were held via Zoom video conferencing. The interview schedule was flexible to meet the participants' preferences of timing. Zoom proved to be a beneficial way to conduct interviews as the researcher and teacher did not have to be in the same geographical area. This allowed for teachers to select the time and location most comfortable for them. Some teachers opted to be at home while others met with the researcher from their classrooms. Interviews were held after school, on weekends, and over summer break. With verbal permission from teachers, the Zoom interviews were recorded and transcribed (see Appendix E).

Additionally, when scheduling the interviews, teachers were also sent a copy of the interview protocol. Teachers had the opportunity to review the questions they would be asked ahead of time, but did not need to have anything prepared. This was implemented as a way to give teachers time to reflect on their potential responses prior to the interview. Additionally, this was implemented to preemptively reduce the amount of time teachers may spend revising their transcripts.

The interview protocol was followed with each participant. The interview questions related to Patton's (2015) six types of interview questions and Merriam and Tisdell's (2016) recommendations for asking good questions and questions to avoid. Creswell (2013) states interview questions should be open-ended, general, and centered on understating the research phenomenon. The semi-structured interviews included prearranged open-ended questions as well

as probes to further expand on information shared. The interviews had a time limit of one hour and thirty minutes. Most interviews did not take the full allotted time.

With permission from the participants, interviews were video-recorded via Zoom. These recordings were transcribed and analyzed. Participants were then given a copy of the transcripts to edit, add information, or leave the document the same. Once participants reviewed their transcripts, they emailed the researcher that it was approved. The researcher sent participants who verified their transcripts a thank you note and a $10 Starbucks gift card for participating.

Data Analysis

Data collected from interviews were analyzed to answer the research questions. Focused on instructional decisions to promote student engagement in math, this data included the perspectives and strategies utilized by primary teachers in three different schools within two school districts.

Data were organized and stored using Qualtrics and OneDrive. Merriam and Tisdell (2016) recommend all data be brought together and organized in a manner that makes the data easily retrievable. This data included questionnaires and interviews.

Interviews were transcribed verbatim. Participants were given a copy of their individual transcript to verify their responses. They had the opportunity to add, delete, modify, or keep their transcripts the same.

Data were analyzed using Glaser and Strauss' (1967) constant comparative method. This method is widely accepted in all types of qualitative research (Merriam & Tisdell, 2016). Constant comparative method involves "taking information from data collection and comparing it to emerging categories" (Creswell, 2013, p. 86). This approach allowed the researcher to begin

coding data as soon as it was collected. Further, the researcher was able to continually compare data for similarities and differences as it were being collected.

The researcher wrote reflective notes in the margins including key concepts or short phrases (Creswell, 2013). Merriam and Tisdell (2016) and Saldana (2016) recommend this approach as a means to document thoughts and ideas as opposed to relying on one's memory for future writing. Merriam and Tisdell (2016) state, "data analysis is best done in conjunction with data collection" (p. 204). The researcher jots down comments or questions that may be useful and is open to any information at this time (Merriam & Tisdell, 2016). Once a participant approved their transcript, the researcher reviewed the document several times and made notes.

The next step was to describe, classify, and interpret data (Creswell, 2013) by coding the information. The coding procedures utilized were first proposed by Strauss and Corbin (1990). The procedures included three phases of coding: open coding, axial coding, then selective coding. Although this method was originally developed for grounded theory, it is commonly applied in other avenues of qualitative research.

Interview transcripts were used in the coding process. The first cycle of coding involved open coding, also referred to as initial coding (Saldana, 2016). This open-ended approach to coding allowed the researcher to "open up the data to all potentials and possibilities contained within them" (Corbin & Strauss, 2008, p. 160). During open coding the researcher was expansive in identifying any information that might be relevant (Merriam & Tisdell, 2016). After all transcripts were approved by the participants, the researcher spent time reviewing how each participant answered the same questions. The researcher created a document to compare responses. Similarities and differences emerged and were coded.

The second cycle of coding involved axial coding. This process involved grouping open codes previously created (Merriam & Tisdell, 2016). Axial coding is also known as analytical coding. This form of coding moved beyond descriptive coding and focused on relating and refining categories (Merriam & Tisdell, 2016). The researcher took the open codes and focused on one category at a time, referring back to data collected to create and enhance categories. Categories and subcategories emerged from this process. Creswell (2013) recommends limiting the number of codes to around twenty-five or thirty.

During axial coding, the researcher organized the open codes into categories and themes. The researcher printed out the document that housed the open codes. The open codes were then cut apart and similar codes were grouped together to create categories and subcategories. Initially the researcher separated the codes to focus on each specific research question, but soon realized there was significant overlap in how participants had answered questions. The categories and subcategories were fluid at this stage.

Finally, selective coding was employed. Selective coding is also referred to as theoretical coding or focused coding (Saldana, 2016). The goal of this method is to use the theory, or core category, propositions, or hypotheses (Merriam & Tisdell, 2016). Creswell (2013) explains, "The researcher takes the model and develops propositions (or hypotheses) that interrelate the categories in the model or assembles a story that describes the interrelationship of categories in the model" (pp. 86-87). The categories or themes were interpreted to make assertions. Creswell explains, "in the final interpretative phase, the researcher reports the meaning of the case, whether the meaning comes from learning about the issue of the case (an instrumental case) or learning about an unusual situation (an intrinsic case)" (p. 101). During the selective coding process, the researcher connected the categories and subcategories to the research questions. The

researcher was able to draw connections, outline the information, and create tables and figures to represent the findings from the codes.

For triangulation purposes, several measures were put into place to support the credibility of the study.

Triangulation

An important strategy to strengthen qualitative research is triangulation. In triangulation, researchers use multiple sources of data, methods, investigators, and theories to confirm findings (Creswell, 2013; Merriam & Tisdell, 2016). Yin (1994) explains, "any finding or conclusion in a case study is likely to be much more convincing and accurate if it is based on several different sources of information, following a corroboratory mode" (p. 92).

For the purpose of this study, triangulation was accomplished through member checking, collaborating with a second coder, and utilizing multiple methods of data collection. Transcripts from multiple participants within the two districts were compared. Several perspectives were represented by different individuals (Merriam & Tisdell, 2016).

Participants had the opportunity to review their interview transcripts. This approach is referred to as member checks, or respondent validation (Merriam & Tisdell, 2016). This ensured the researcher's interpretations were in alignment with the participants' perspective. Participants had the opportunity to add, delete, or modify their transcripts. Following, they sent the researcher an email once they were done reviewing the transcript stating they approved it.

Additionally, a second coder reviewed de-identified transcripts and determined codes separately from the researcher. The second coder was a doctoral student in the college of education at Northern Arizona University. The second coder did not have a vested interest in the

research outcomes. The researcher and the second coder shared a large amount of agreement in coding the transcripts.

Lastly, multiple methods of data collection were utilized to confirm findings. The study included a questionnaire and an interview protocol that were used to compare and check against one another. Additionally, having an outside person (i.e., principals or colleagues) nominate participants supported triangulation of data collection. The selected participants were deemed 'exemplary' in the eyes of their colleagues or leadership team. Teachers also self-reported on the questionnaire they received high ratings in the area of student engagement on their annual teacher evaluation. Thus, both principals and colleagues agreed with the teacher that they demonstrated proficient student engagement techniques.

Credibility, Transferability, Dependability, and Confirmability

Lincoln and Guba (1985) use the terms credibility, transferability, dependability, and confirmability to describe trustworthiness in qualitative research.

According to Lincoln and Guba (1985), credibility is a two-fold task. It involves executing the study in a way "that the probability that the findings will be found to be credible is enhanced" (p. 296) and having the findings approved by the participants. This was accomplished through member checks.

Transferability refers to "the extent to which the findings of one study can be applied to other situations" (Merriam & Tisdell, 2016, p. 253). Creswell (2013) explains thick description is needed to ensure the findings are transferable between the researcher and the participants. The researcher accounted for transferability by detailing descriptions and drawing connections from the findings.

Dependability denotes the results are consistent with the data collected (Merriam & Tisdell, 2016). A reader of a study should be able to agree that given the data, the results make sense (Merriam & Tisdell, 2016). This is achieved by being detailed and transparent with research procedures, data collection, and the process of data analysis.

Confirmability is defined as, "the extent to which the data and interpretations of the study are grounded in events rather than the inquirer's personal constructions" (Lincoln & Guba, 1985, p. 324). Confirmability can be established through an audit trail (i.e., keeping a research journal on the study's process) or triangulation (Lincoln & Guba, 1985; Merriam & Tisdell, 2016). This study incorporated triangulation practices. Additionally, a bracketing interview was conducted prior to data collection to addresses the researcher's biases.

Summary

This case study falls within the interpretative paradigm. The purpose of this study was to explore instructional decisions exemplary primary teachers used to promote math student engagement. Specifically, this involved looking at what materials are *given* to teachers and what materials they actually *used*.

This case study was bound by two public school districts during the 2021-2022 and 2022-2023 school years in the American Southwest. Upon IRB and school district approvals, the researcher contacted elementary school principals with study information and participation consent forms (see Appendix A-C).

Requirements for participation existed for both the school districts and individual participants. The school districts had to be public school districts with an adopted math textbook program. Participants in this study taught at three different schools within the two school districts. In this study, the participants' requirements included teaching a general education

primary grade, teaching math as a part of their instruction, have some amount of creative control for selecting math materials, and were deemed an 'exemplary' teacher according to their annual teacher evaluation in the area of student engagement practices (i.e., received high ratings in the area of student engagement).

Semi-structured interviews were the primary source used to collect data (see Appendix E). A questionnaire (see Appendix D) was also given to ensure the individuals met the participant criteria and to collect background information. The interviews were conducted via Zoom video conferencing. The interviews were recorded and transcribed.

Pilot testing was conducted to refine the study. Once revisions were made, the researcher moved forward with recruiting participants and collecting data. Data were stored and organized using Qualtrics and OneDrive.

Data were analyzed using Glaser and Strauss' (1967) constant comparative method. This allowed the researcher to start coding data as soon as it was collected. The data were coded according to Strauss and Corbin's (1990) model of open coding, axial coding, then selective coding.

Triangulation involved multiple methods of data collection, multiple investigators, and member checking. Principals, senior figures, or colleagues nominated teachers for participation who exhibited exemplary student engagement practices. Teachers also self-reported they received proficient ratings in the area of student engagement on their annual teacher evaluation. Responses from the questionnaire and interviews were compared against each other to support multiple methods of data collection. Member checks involved the participants having the opportunity to review their transcript. Teachers were able to modify their transcript as necessary and sent an approval email when done reviewing. Finally, a second coder reviewed de-identified

transcripts and coded the data separately from the researcher. The researcher and the second coder agreed on the majority of codes. Multiple cycles of coding occurred to create themes and make assertions regarding the findings. Pseudonyms are used in the final document for confidentiality purposes.

CHAPTER 4

RESEARCH FINDINGS

This chapter contains the findings obtained in a case study from the questionnaires and interviews of five exemplary primary teachers regarding their instructional decisions to support student engagement in math. The questionnaires and interviews were used to collect information to answer the research questions:

1.) What instructional decisions are exemplary teachers making to engage students in the area of primary math?

1a.) How do primary teachers define student engagement?

2.) What changes, if any, to district-provided instructional materials are exemplary teachers making with the intention to enhance student engagement in primary math?

This chapter includes an overview of the findings specific to the research questions. The participants' responses to the interview questions and questionnaires are weaved throughout the chapter to describe their experiences making instructional decisions to support student engagement in math.

The School Districts

The two participating school districts were in the American Southwest. The school districts remained anonymous in this study. One district was relatively small, and the other was large in terms of student enrollment. The study requirements for school districts to participate included: (1) the school district must be a public school district and (2) the school district must have an adopted math program. Both school districts met the criteria for participation.

The Schools

Teachers from three different schools were represented in this study. The elementary schools either offer kindergarten-5th grade or kindergarten-6th grade. The schools varied in their approach and philosophy to education.

One school was a traditional academy. This school had a curriculum-centered approach to learning with its 'back to basics' model. The school offered a rigorous accelerated learning environment and high expectations for both achievement and student behavior.

The second was a neighborhood school. The school emphasized a family-style environment in which parents, teachers, and students work collaboratively to ensure success. This school prided itself on being technologically advanced with student devices.

The third was a magnet school that emphasizes project-based learning, fine arts, systems thinking, and outdoor education. This school has received national recognition for being a top magnet school in America.

The District Math Programs

The districts each adopted at least one math program. Both district math programs included a teacher manual and student workbooks. The districts also offered supplementary materials such as an additional program to pull lessons from or a separate online math program. The math programs discussed will remain anonymous in this study. The extent to which teachers utilized these math programs differed depending on the school setting. This will be further addressed.

The Teacher Participants

Teachers from two different school districts in the American Southwest made up the sample size. To participate in the study, five requirements had to be met:

1. The participants had to be a general education teacher.
2. Participants had to teach a primary grade (i.e., kindergarten, first, second, or third grade).
3. The teacher had to instruct math during a typical school day.
4. Teachers needed to be deemed as 'exemplary' in employing student engagement strategies. To be considered 'exemplary', teachers needed to receive an above average rating on their annual teacher evaluation in the area or student engagement practices.
5. Teachers at the selected school needed to have some flexibility to choose appropriate math learning materials.

To ensure teachers met the criteria to participate, principals, senior figures, or colleagues nominated teachers for study involvement. Additionally, each teacher completed a questionnaire to verify they met the requirements. All five teachers met the requirements to participate:

1. Each teacher taught in the general education classroom.
2. The participants included two kindergarten, one 2nd grade, and two 3rd grade teachers.
3. On the questionnaire, teachers stated their math block was typically 60-90 minutes daily (one teacher said 45 minutes on early release days).
4. Four of the five teachers were recommended by a principal or senior figure that acted on behalf of the principal at their school to participate in this study. By principals/ senior figures recommending teachers, they acknowledged the teachers were exemplary with student engagement strategies. One teacher was recommended by a participating teacher (i.e., snowball sampling). By recommending a peer, the exemplary teacher was recognizing their colleague as exemplary with student

engagement strategies. Additionally, teachers were given a questionnaire to self-report they met the criteria. On the questionnaire, teachers were asked, 'On your teacher evaluation this year, did you receive an above average rating in the area of student engagement practices?' Each of the five teachers responded with "yes" (see Appendix D).

5. By principals/ senior figures nominating teachers, they acknowledged teachers have some flexibility to choose math materials. Additionally, the questionnaire asked teachers to describe their amount of creative control in selecting math materials. Each teacher responded with varying degrees of flexibility, but all mentioned they had some amount of creative control in selecting math materials.

Background information of Participants

All five primary educators were certified teachers. Each teacher received a bachelor's degree, and one teacher also obtained a master's degree. The sample size for this study included five females. The participants ranged in age from late twenties to early fifties. Their years of teaching experience ranged from three years to twenty-one years. Additionally, their experiences for grade levels taught varied. One teacher had only taught one grade level whereas the other teachers had taught at least two or more grade levels. Collectively, these teachers have taught preschool, kindergarten, first grade, second grade, third grade, and fourth grade. One teacher also had experience teaching Special education (preschool and K-1) for a combined eighteen years.

It was important school districts, principals, and teachers remained anonymous, in order to feel comfortable participating in this study. It was imperative teachers felt they could answer questions openly and honestly. Therefore, names were not used in this final document. Pseudonyms were used to protect the identities of the participating teachers. Pseudonyms used

throughout this study for the participating teachers are Charlotte, Elizabeth, Abigail, Natalie, and Louisa. Additionally, the school districts, schools, principals, and adopted math programs also remained nameless. Charlotte and Louisa taught third grade, Elizabeth and Abigail taught kindergarten, and Natalie taught second grade during the time of their interviews.

The Questionnaire

Once a teacher was nominated by a principal, senior school figure, or a participating teacher, they were sent a recruitment email with two links. One link was to sign the informed consent document via Qualtrics to participate. The other link was to complete the questionnaire via Qualtrics. The questionnaire was used to gather background information and ensure teachers met the criteria to participate in the study. The five teacher participants signed the informed consent documents and successfully completed the questionnaire (i.e., they met all the participation requirements).

The Interviews

Interviews were conducted via Zoom and scheduled to best accommodate the teachers' schedules. Some teachers preferred meeting after school, over summer, or on a weekend during the school year. The flexibility of using Zoom allowed for teachers to select a time and place comfortable for them. For example, some teachers were in their classrooms while others were at their home. Meeting via Zoom was convenient and allowed the researcher and participants to meet while in different geographical areas.

For consistency purposes, the interview protocol was followed with each teacher participant. All teachers were asked the same fifteen questions. Depending on the conversation or what the teachers had shared, the bulleted subquestions were used at times as a follow up (see Appendix E). The interview protocol includes many subquestions, allowing the researcher to elicit a more detailed response or clarification.

Research Question Findings

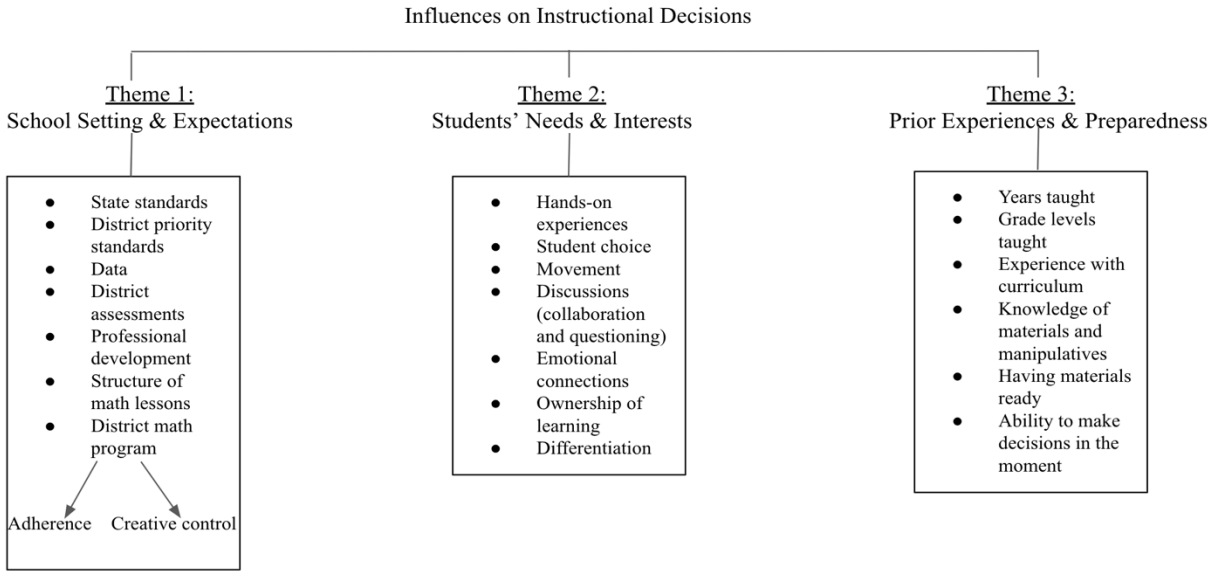
Research Question 1

What instructional decisions are exemplary teachers making to engage students in the area of primary math?

Throughout the course of the interviews, it became apparent it's important to first understand the context for how exemplary teachers made their instructional decisions. In the analysis of the interviews, three themes emerged as influencing instructional decisions: (1) the school setting and expectations, (2) students' needs and interests, and (3) prior experiences and being prepared. Each of these themes will be described in further detail. These themes will be connected to the engagement strategies exemplary teachers implement in their classrooms. Figure 1 depicts the themes that influenced teachers' instructional decisions regarding math student engagement. It also displays the strategies teacher implement or their reasoning behind their instructional decisions.

Figure 1

Influences on Instructional Decisions



Theme 1: The School Setting and Expectations

The School Setting. An important part of understanding teachers' instructional decisions to engage students in math was learning about the school environment where they teach. The school setting has influence over the engagement strategies teachers implement. The five participants teach at three different schools. The types of schools ranged from traditional, neighborhood, and magnet schools. Each school offered a slightly different approach to education. The school setting impacted the amount of creative control teachers have when deciding which math materials to use, how to structure math lessons, and math engagement strategies. Table 2 represents the different types of schools as well as the amount of creative control teachers described they had to make instructional decisions. (Please note this table shares additional information, such as changes teachers make to district math materials that will be addressed in Research Question 2.)

Table 2

Creative Control for Making Instructional Decisions

Creative Control for Making Instructional Decisions					
Teachers:	Charlotte	Elizabeth	Abigail	Natalie	Louisa
School setting:	Traditional	Neighborhood	Neighborhood	Magnet	Magnet
Creative control:	Minimal	Significant	Significant	Some	Some
Reasoning for amount of creative control:	Traditional school- the content (mainly) must be traditional math program Selects manipulatives If reteaching, can choose any resource to support students.	Good student test scores Conversations with principal Able to use district math program as a tool	Good student test scores District would like them to use math program, but the students come with a variety of needs. They have wiggle room to select materials that will support students.	Able to use any/ all materials provided from the district Recommended they use manipulatives Selects manipulatives	Integrates other content areas with math (i.e., art, science) Flexibility with using the district program, doesn't have to be used to a T Able to supplement Selects manipulatives

Creative Control for Making Instructional Decisions					
Teachers:	Charlotte	Elizabeth	Abigail	Natalie	Louisa
Math materials utilized:	Textbook for traditional program Online district math program Student workbooks Modification packet Secondary district math program Manipulatives Math games Posters YouTube videos Teachers Pay Teachers materials White boards	Some materials from district math program Online district math program Manipulatives Math games 'Must do/may do' choice boards YouTube videos Teachers Pay Teachers materials Google Classroom Art activities White boards Hula-hoops (i.e., materials to have students move)	Some materials from district math program Online district math program Manipulatives Math games Choice boards Read alouds to match the math concepts Exit tickets	Teacher manual Student workbooks Math journals Manipulatives Math menu Specialty markers Anchor charts Exit tickets	Teacher manual (as a guide) Online math program Student workbooks Math journals Manipulatives Math presentations Anchor charts Exit tickets
Changes to district provided math materials:	Note-taking (uses kid-friendly terms) Manipulatives YouTube videos Virtual classroom during COVID Online manipulatives	Manipulatives and games Pick and choose lessons from district math program Doesn't use district student workbooks Choice boards Student projects (art, create a math game, make a math book)	Manipulatives and games Pick and choose lessons from district math program Doesn't use district student workbooks Choice boards	Manipulatives Markers Making note of changes for next year (first year using this district math program) Condenses lesson if it is too long Incorporates student choices	Customizes math presentations Integrates math with other content areas (science, engineering, and art)

Charlotte, an exemplary third grade teacher at a traditional school, shared she strictly adheres to the math programs designated by the district and her school. Being that she teaches at a traditional school, her school implements a traditional math program and supplements with an online program and an accompanying math program to comply with state standards. On the questionnaire, teachers were asked to share their amount of creative control in selecting math

materials. Charlotte responded with, “I can pretty much choose whatever manipulatives I need for math, but the content (mainly) must be [district traditional math program]. If I need to reteach a concept, I can basically choose any resource I need.” She also said she used manipulatives that she or the school will provide. Charlotte explained, “There are some manipulatives bought by the district as well as any consumables required by the curriculum, but anything other than that is usually bought by me.”

During the interview, Charlotte confirmed she used the district resources with fidelity. She explained because the district math program spirals, it does not really allow teachers to skip lessons. She said, “You can combine a few here and there. But you can’t really skip around. I can use whatever manipulatives I need or want.” However, Charlotte mentioned if the class is struggling with the content, she can reteach using supplemental materials of her choosing. Charlotte said, “… If [there’s] a situation where…the majority of the class didn’t understand a concept, then I have the creative control to stop those lessons for a day or two and reteach using whatever is going to help them understand the concept.” She explained once she reteaches the content, she will pick back up where she left off with the district math program.

Charlotte’s structure for her math lessons begin with a math warm up. Students solve a workbook page that typically takes ten minutes to complete. The warm-up includes practicing math facts, mental math problems, and one problem-solving activity that Charlotte explained is similar a word problem, but more difficult. Students are expected to answer in complete sentences. The core lesson of the day comes directly from the district math program. Charlotte said she and her class create notes using student-friendly terms. During the lesson she plays a 2–3-minute video that visually demonstrates how to solve the problem. Following the video, they solve a few problems together. Charlotte will clarify the math concept as needed and/or has

students discuss in groups. Finally, students are given thirty minutes in class to work on their homework. Monday-Thursday they have thirty problems to solve nightly but often many students finish during class. Charlotte explained students can work with a partner on their homework or gain help from designated peer 'experts' (students that have mastered the skill and able to help others). During this time, she works with small groups of students that need additional support with their homework.

On the opposite end of the spectrum, both exemplary kindergarten teachers Elizabeth and Abigail shared they have a significant amount of creative control and rarely use the district math program. The two are teammates and teach at a neighborhood school. Instead of using the district workbooks, they opt for more of a hands-on approach with games, manipulatives, and utilize small group lessons as opposed to whole group lessons. Both teachers described they do not like using worksheets and instead want to incorporate developmentally appropriate math strategies for their young students. When asked about their amount of creative control on the questionnaire, Elizabeth responded with, "… [District math program] is a tool. We are to use the tool and other means to teach the standard as long as it meets district guidelines and is appropriate." She views the district math program as a resource but does not need to follow it precisely. She also wrote, "I also have creative control over all other resources as long as I am meeting the needs of the students, being appropriate, teaching the standard, and… differentiat[ing] learning to meet the needs of the students and move them forward."

Elizabeth and Abigail explained that because their students have achieved high test scores, they are given more creative control. Elizabeth shared she has had conversations with her principal about the district math program and is given "more leeway" because her hands-on approach to teaching math has shown positive results. Elizabeth said she will discuss with her

principal what she is doing and why she is making these instructional decisions. Elizabeth said, "…I do assess the kids… and their scores and the data, and it shows that the hands-on is used. So, I don't get questioned a lot, and I'm really allowed to do a lot of what I want." Similarly, Abigail shared her students did well on the end of year assessment with her hands-on approach. She said, "…We got good numbers on our final assessment. They got in the nineties for math. They were solid. I think the play-based works. Yeah, so I mean, we're not research-based, but we're numbers-based (laughs and smiles)."

When asked if she is required to use any specific instructional materials, Elizabeth explained when she transitioned from Special education to the kindergarten general education classroom, she asked about which materials she needed to use. She said, "…I was told, 'This was the curriculum for kindergarten, use it as a tool.' And I said, 'All of them?' and they said, 'Yes, except for… our phonics program. Other than that, please use everything as a tool." From their conversation, Elizabeth said her understanding was the district math program is a resource and not a requirement per se. She said the math program is "…a tool to assist in meeting the standards and having children learn. So, unless I didn't understand that, but I was told it was a tool." Earlier in the interview, she also mentioned the district adopted a secondary online math program this year that she uses. She said the program includes games that are based on students' skills and their abilities.

Regarding required materials, Abigail shared she has the flexibility to teach the content in a creative way. She did mention however the district wanted them to use a secondary online math program this year which was different than their core math program. She said this online program was "a big push this year". She explained the online program is supposed to be intuitive, so there are no words, but students can manipulate items on the screen.

As for the district math program, Abigail said, "…they want us to go through and try to find the standard and do as much as we can out of it and use it as our primary source." She explained that she and Elizabeth would go through the book and pick and choose what worked for their students. They would see what content they needed to teach then switch out the student workbooks for games and hands-on activities. Abigail said, "So that was where Elizabeth and I used our creative talents, too… building games and things that are engaging."

Both Elizabeth and Abigail were asked about the structure of their math block. Elizabeth first discussed her goal for the lesson. She explained her priority is having students understand what and why they are learning. She said, "…I really am trying to get the children to- they're five, and they're in kindergarten. I get that. But I still want them to own their learning, to understand what they're learning, and how they're learning." She discussed that her structure depends on the time of year, and that the beginning of the year looks very different from end of the year. As the year progresses, she does more facilitating and students do more leading of the lessons. They start their day with a math routine, in which the skills will vary depending on the time of year. After that, she implements a short whole group lesson to introduce the topic (5-7 minutes). Following, she says, "…It just depends on where the lesson of the day is going. Small group, individual, and it's going to be… hands-on. They're five." Then she explained she has a choice board that includes must-do's and may-do's for students. The choice board previously contained level-based activities but now includes skill-based activities. She said the activities are often hands-on, although she may include a worksheet just for them to practice using a worksheet. Once students are done, they bring it to her and they review it together. While students are completing the choice board activities, Elizabeth is working with students in small groups or individually.

Abigail's math structure begins with a math warm-up that will include a game or a 'math talk'. They then transition into a short whole group lesson to cover the math concept. She explained she does a gradual release for students. Abigail explained she would release students back to their desks that were ready to work independently. If students needed or wanted extra help, they would continue to work with Abigail. She said, "If they wanted my support, they just stayed with me. They would come and sit with me on the floor."

Following, the students work on their math menu (same concept as Elizabeth's choice board) independently. Abigail shared she is open to students choosing where they work during this time. She provided the example, "…If you're doing [the math menu] and you want to sit by a partner, I'm fine. This year we're calling it 'PIG'. So, it's, you can have a partner, it could be independent, or you can have a group." She said she's flexible with students picking where they work as long as they are focused and not messing around.

As students finish their work, they play partner games. While students are playing these games, Abigail will work with students that need additional support or will implement math intervention during this time. She said she sometimes uses exit tickets and will use them to identify who needs extra support or work with students to quickly fix their error(s).

Exemplary teachers Natalie (2nd grade teacher) and Louisa (3rd grade teacher) both teach at the same magnet elementary school. Their school setting influences their instructional decisions because the school places special emphasis on project-based learning, fine arts, literature, outdoor learning, technology, and systems thinking. Both teachers discussed some of these aspects when describing their instructional decisions regarding student engagement. Both teachers shared they have some creative control when it comes to math instructional decisions.

The district adopted a newer version of the district math program, so this is their first year using the updated version.

Natalie shared she has some creative control when selecting math materials to use. On her questionnaire she wrote, “I can use any and all of the resources/materials provided but it is recommended that we use place value blocks or magic ten frames to model numbers on place value charts to support a strong understanding”. During the interview she shared she believes it is required to use the newer district math program. She said, “…I really make it a point to follow. I would be scared. It’s where I am in my experience, and I don’t have a lot of experience with other curriculum. I make sure I teach, I follow it.” She said she uses the teacher manual often along with the student workbooks.

Natalie stated she has choices to decide which manipulatives and materials will work best for students. She explained she will pick the manipulatives that will work best for lessons. She explained this is the first year she is using ten frames in math. Previously, she used place value disks and blocks. She said the blocks are a great visual but, depending on the lesson, the ten frames will work better. She shared, “So, I guess as you learn, you find out that certain manipulatives are better than others.”

Natalie also finds it important to let her students have some amount of creative control in math. As much as possible, she will let students represent their mathematical knowledge in different ways. She gave the example that sometimes students do not want to build, they would rather draw their math understanding. She said in this scenario, “I give them choice of what to do.” Natalie described how she modifies the math district program to allow for more student choice.

Natalie's structure for her math lessons begin as soon as students enter the door. She has materials already setup. She assigns spots for students to sit during the lesson based on their needs. She noted she considers student behaviors and students that need extra support. She starts with a quick write such as, "Tell me everything you know about the number 123." Students will respond to this question in their journal by writing or drawing. During this time, she plays relaxing music. After a few minutes, she will call on one to three students to share their work under a document camera and explain their thinking.

After that, the class will get into the lesson, focusing on the learning objective. Depending on the content, Natalie will teach whole group or have students work together in small groups or pairs. She explained, "I just have to see the lesson and see what will [work]." One strategy she implements is pairing students based on their abilities. She provided the example, "I'll pull high and low students together. And the high student will draw, and the lower student will build. And they work together, so they have- so I'll preset who's there, and of course they don't know it's high/low."

Following the lesson, students have the option to work on a district intervention program or keep working on the problem set. Ideally during this time, Natalie is working with students that need additional support with the lesson. Finally, she will close out the lesson with some sort of debrief such as, "Based off of what you learned, what name could you give the lesson?" They will discuss the lesson and some days she will give an exit ticket, but not necessarily every day. She did state that even if she doesn't give an exit ticket, "I do try to get an idea of where they are no matter what."

Louisa shared her level of creative control is "pretty flexible". In her questionnaire she wrote, "I am allowed to adapt and supplement as I see fit". When asked during the interview if

she is required to use certain materials to teach math she said, "[District math program], I think because it's the district curriculum, I think we have to have the book in our classroom somewhere. As far as us using it to an absolute T, I don't think… it's required."

She also explained her school setting impacts her instructional decisions. She said, "Our school is… heavy in project-based learning… If we [can] integrate across different content areas, we always have the green light to do that, especially if it's student driven. We love capitalizing on student questions and... student interest." Louisa explained she can supplement as she sees fit. She gave the example that she may opt to combine art and math. She said, "I don't ever feel like I have to get permission to do those things… I guess [it's] the philosophy of the school that I'm at. They want you to do that. They push for it." She explained throughout the interview that she incorporates math with different aspects of STEM (science, technology, engineering, and math) such as art, engineering projects, or design projects. She shared she enjoys bringing STEM into the classroom and likes combining content areas.

Louisa shared she does utilize the content from the district math program. However, she will make changes so it more relatable for her students. She said she uses the math program as a guide. She said the math program includes math presentations that she customizes to make it more personalized for her students. For example, she will use her own math problems and use students' names. She explained that she uses some elements from the district math program such as the math videos, problem sets, and exit tickets.

As far as the structure of Louisa's math lessons, it begins first thing in the morning. Students come in and put their things away and start with a bell work question. The bell work question typically involves a word problem that students solve independently. They are taught to use a process called 'RAD W', which stands for read the problem twice, write an answer

sentence, draw a model or picture, and then write an equation that solves the problem. Louisa looks for these elements as they go over it as a class.

Next, the class has a morning meeting that includes a social-emotional check-in. Students will then answer a 'quick write' question on the board that connects to what they previously learned in math. It is a way to review from the last math lesson. They have two minutes to discuss with each other on the rug before they go back to their seats to write a written response to the question. Once students have responses, Louisa will pull popsicle sticks with their names on it to share their quick write answer. Students may share their work or describe if they drew a picture. Following, they review additional practice skills such as math facts, rounding, or skip counting.

After the review, Louisa begins the main lesson. Louisa explained she teaches math whole group and two individuals come in to help, a teacher's assistant and a special education teacher. She typically begins with a math video or students work with manipulatives. She will then build upon the lesson objective. She follows the format of 'I do, we do, you do' with modeling an example, working on the problem together, then students complete problems independently. Sometimes they use whiteboards, math books, or math journals to solve. Students usually solve three to five problems to practice then complete an exit ticket. They will turn in the exit ticket and Louisa will grade it. Based on how students perform on the exit ticket, she will reteach the concept if there are glaring issues or keep moving on if students demonstrate understanding. Students can work with a partner or ask for help, but the exit ticket needs to be completed independently.

Expectations. Teachers mentioned their instructional decisions were based on certain expectations such as following state standards and meeting district guidelines. When asked,

‘What instructional decisions do you make to engage students in math?’ Elizabeth said, “I look at data. So, what their needs are, where their needs are, and where they are. What skills they need with the standards.” Elizabeth stated she is mindful of data but is also cognizant of individual student needs. She said, “I also look at, not just data based on the skills, but also just the child. If the child needs to get up and move. If the child needs more quiet spaces… and then… the standards and… the objectives.” She later shared that in addition to the standards, they have a district curriculum guide, “We have the standards and our district curriculum road map... These are the standards that we are teaching.” Similarly, Abigail shared, “The district lays out the priority standards.” Abigail also mentioned that while she has creative control to decide *how* to teach math content, her lessons are structured around the standards, “The creative control was how we taught it”. She explained she dissects the district math materials to figure out how to make it fit the standards.

Natalie shared she ensures she hits the standard by reviewing and paying special attention to the learning objective, “I really do try to just figure out what I need to teach, and really figure out the vocabulary… make sure I understand the objective myself”. To help her keep the learning objective in the forefront of teaching, she said, “…Usually I'll just do a sticky note and I'll write out exactly- if all else fails, if I taught *this.”*

When Louisa was asked about what math materials she uses, she said, “…It's really dependent on what the… standard is that we're supposed to be learning that quarter.” Louisa will base instructional decisions on the standards.

Additionally, three teachers discussed implementing learning from professional development opportunities provided by their school districts. Teachers shared they attended

conferences, trainings, or worked with math specialists. They spoke positively of their experiences and were excited to implement new math strategies.

Theme 2: Students' Needs and Interests

Throughout the interviews, every teacher discussed they make instructional decisions based on students' needs and interests. They described students' knowledge shapes their math instruction. This knowledge allows them to tailor the learning environment and math lessons to support students emotionally, socially, behaviorally, and academically. To supports students' needs and interests, teachers incorporate hands-on experiences, choice, movement, collaboration/discussion, questioning strategies, emotional connections, student ownership of learning, and differentiation.

Hands-on experiences. Every teacher shared they use hands-on materials or manipulatives to support students' understanding.

Both Abigail and Louisa shared they use a more hands-on approach to help struggling learners. Abigail said, "It's really just getting to know the kids… There's some years where certain kiddos really need manipulatives. Certain groups of kids, they need hands-on things because those base concepts aren't there." Similarly, Louisa supports struggling learners, she said, "… I always try to have some sort of hands-on option. That if for whatever reason it's not clicking with them… we can easily grab it. In the past, I've worked with play-doh a bunch… for fractions and number lines." Both teachers use hands-on materials to differentiate for their students.

Both Elizabeth and Abigail shared they want to make math more tangible and play-based for their kindergarteners. Abigail said, "We… were constantly trying to make sure that it was play-based, and that it was appropriate for them, and they weren't staring at a worksheet every

day." Abigail also said, "At five, they need to have hands-on. They need to have play. They need to know that math is all around them, not just in this book." Elizabeth also opted for a hands-on approach and minimized the use of worksheets. Elizabeth said, "We have blocks, counting bears, we use so many manipulatives. Once again, five-year-old kindergarten[ers] need the hands-on. They need to hold. They need to move it around." Elizabeth and Abigail both discussed they use a lot of different manipulatives and games to support a hands-on approach to learning math.

Natalie and Louisa both shared they use hands-on learning to promote student engagement. Natalie said, "Sometimes a lot of the engagement is from using manipulatives." She shared she likes to use a variety of manipulatives. She also incorporates choice when it comes to manipulatives. For example, students may choose to build, draw, or use a place value mat.

Student choice. Most of the teachers discussed incorporating choice in their math block. However, the extent to which they utilize student choice varies. Student choice included deciding which materials to use, how to represent their math understanding, which math activities to complete, flexible seating, and the option to work independently or in a small group.

Natalie spoke highly of student choice being the epitome of student engagement. Natalie said she lets the children select materials and manipulatives that will help them represent their mathematical understanding the best. She explained, "I try to give them a lot of choice. As many choices as I can give them, I try to give them." Natalie shared the example, "If a kid says, … 'Can I draw my place value chart?', and I know they can do it, I'm like, 'Of course you can…". If they make a special request, and… they're ready for it… I'll do that." Elizabeth also gives her students the creative freedom to represent their mathematical understand in different ways. She shared for her advanced learners that needed more of a challenge she would give them choice to create posters, books, or games to teach a math concept. For example, she said when they were

learning about the ‘Friends of Ten’, students created posters or made books with folded papers. The students would then present their project to the class.

Elizabeth, Abigail, and Natalie explained they use a math menu/choice board to give students the opportunity to choose math games or math skills to practice. Elizabeth noted her students’ choice boards included both ‘must do’ and ‘may do’ options. Abigail shared her choice board included leveled games. Additionally, once students finished all the activities on their choice board for the week, they got to choose between different partner math games to play. Natalie noticed students were more engaged when they were given choices for their math menu. She said, “Kids get really excited when they can make choices. Like, giving them a math menu. They're much more engaged than just telling them that they have to [do a certain activity].” Natalie will explain the math menu options to her students. She shared, “I notice they get really engaged… when I'm teaching them the (math) menu. I'll say things like, ‘If you think that you really need extra work or support in this area, this is the center for you’.” Natalie noticed giving students choices empowered them to make decisions and own their learning.

Charlotte gives students choices to work independently, with a partner, or in a small group on the nightly homework. Her students have 30 minutes in class to work on it. During this time, she said, “Most of them choose to work in groups. There's a few who usually work by themselves, but sometimes they're like, ‘Oh, no, I want to work with so and so, because they understand adding fractions and I don't’.” She also noted sometimes students will choose to work independently. Charlotte said, “And then there's some (students) sometimes who usually work with others, but then they're like, ‘I'm just having a bad day, I want to work by myself’.” She did explain she tells students they can help each other arrive at answers, but they can’t give each other answers.

Elizabeth, Abigail, and Natalie also discussed using flexible seating to give students additional choice. Elizabeth said, “So, when you walk in my classroom, you're not going to just see all kids sitting at tables or all kids sitting at desks. You're going to see kids throughout the entire room. Some laying on the ground...”. Elizabeth shared she used flexible seating because “it's just really about meeting their needs so they can learn.” Abigail shared she has different seating options for her students. She said students have the option to use a chair, work on the floor, sit in bean bags, sit at a round table, use a wobble seat, rocking chair, or sit on small cushions. Similarly, Natalie shared she utilizes flexible seating. Her classroom contains high tables, low tables, round tables, individual desks, and floor desks.

Movement. Elizabeth, Abigail, and Louisa shared the same sentiment that students need movement. The three teachers make it a point to incorporate movement into their math lessons. Elizabeth explained movement helps to keep students engaged. She said, “I also love activities where they're getting up and they're moving because the more they move, the more engaged they are, especially at this age… if I can get them up hopping… then they're going to be more engaged…”. Abigail also likes to have students up and out of their seats during math. Abigail said, “Let's go, let's move around the room. Let's jump from number to number, go find the number… movement was always good in kindergarten. They love that.” Abigail provided more examples, such as, “Go touch it on the wall. So, I would put up different shapes on the wall, and they would walk around and, ‘Everybody put your finger on a triangle…”. Likewise, Louisa said students are constantly moving around the room and barely in their chairs. Louisa highlighted movement as an engagement strategy when stating, “I think anything that involves movement, where they're rotating through or they're working with a partner…I feel like that

definitely promotes student engagement." The intentional use of movement was a popular strategy amongst these teachers.

Discussions (collaboration and questioning). Each teacher mentioned they embed discussions in their math instruction. The teachers shared they will have students work in pairs or small groups to collaborate on solving math problems. Additionally, Charlotte mentioned throughout her interview the power of questioning as an engagement strategy.

Charlotte enjoys having students teach each other. She will designate certain students as 'experts' that can help teach other students during homework time. She said, "So here at this school, what promoted the most engagement was the student discussion… Those kiddos who I call my 'experts', when they get to teach… they love teaching it to people… that's helped a lot with the engagement." Charlotte followed this sentiment by stating, "They love to talk. They know that it's going to be math talk only, but they get to talk to each other. So, they're like, 'Yeah, can we hurry up and do our homework, so we can work together?' (laughs)." Natalie also explained she will intentionally pair students based on abilities. Partners will work together where one student is above or on-level and one student is below level (i.e., high and low with the math concept).

Discussions are a part of each teacher's math block. Charlotte has students collaborate during their homework time. Elizabeth and Abigail use multiple math partner games. Abigail also begins her math block with a 'math talk'. Natalie incorporates 'turn and talk' and discussions. Louisa incorporates math partner talks to work together to discuss the quick write problem. Abigail explained she can tell by the volume and tone when students are engaged in discussions. When asked what engagement sounds like and looks like, Abigail said, "What it sounds like usually is chatter. It's not yelling… it's not loud, but it's not silent. Like you know

they're talking, but they're still working." Abigail explained she could see discussions and if they were working on the task at hand. She said, "…How I knew they were engaged was, I could see them working. I could hear just the chatter of a classroom that was on a good level. And then just the work that was coming in."

Charlotte shared she uses questioning strategies to engage students. She will ask students to explain their thought process on their work. When asked about her favorite engagement strategy, she responded, "Really, questioning is the biggest one, and kind of defending their answer, almost like debate. We used to do Socratic seminar a lot in ELA, and I kind of use that for math, just not so formally." Charlotte also explained that early in her teaching career she used to feel worried she did something wrong if students didn't understand a concept. Nowadays she sees the productive struggle of students talking though a problem as beneficial. She said, "I've learned that struggle is more beneficial than it is harmful." She explained, "I've learned those kinds of strategies to help them talk through and walk through those struggles, and instead of getting frustrated and giving up, looking at it from a different perspective. So, kind of working through those things."

Emotional connections. Teachers expressed not only is it important for students to enjoy the math lesson, but also the teachers. The teachers discussed they want math to be fun for their students and they also want to enjoy teaching it. Teachers often take students' feelings into consideration when planning lessons.

Elizabeth and Natalie will take into consideration their students' interests. Elizabeth shared at the beginning of the year, she keeps in mind what four- and five-year-old students enjoy. For example, they often like blocks and movement. She said, "As the year goes on, I really pay attention to my students, …what they like and what they don't like, and try to get

things that they're a little bit more interested in, are going to pique their interest." She also said at the end of the year she will have a conversation with her students and ask them about what they liked and didn't like. She said students will be very honest when sharing and explain their reasoning for liking or disliking something.

When asked what instructional decisions she makes to engage students in math, Natalie responded with, "I think about what they would like." She also shared she spends time talking to her students about having a growth mindset. She first wants her students to believe in themselves and have a mindset that they can be successful with math. Natalie said, "…You got to let them know that they can do it, even if it doesn't feel good… maybe they haven't had a good experience with math… but they need to know that it's possible, that they can do it." She elaborated with, "They might be a little slow. …They might have to do different things to get there. But… everyone can do math. So that's the message that… I try to give the kids from the very beginning." Natalie wants students to not only enjoy math, but feel confident in working through difficulties. She mentioned, "When you see kids are unhappy, you know you're not going to get the results that you want." This sentiment highlights the importance of being emotionally connected to the lesson.

Abigail said she wants to make learning fun for her students. She wants them to be "happily working towards their goals". She also noted excitement is contagious. She said, "The littles are pretty easy with engagement. So, if you get excited, they're going to get excited."

Louisa shared she hopes for her students to be emotionally connected to math. She explained she likes to integrate math and art because not only is it more fun for her to teach, but it opens doors for students that may not feel confident with their math abilities. Louisa said, "Students who might not think that they're a mathematician, can all of a sudden, be having these

great mathematical ideas when they're creating an art picture." She further shared, "… Being that person to help them realize that they're doing a math problem, while they're doing an art project… I feel that's an awesome opportunity for me to be able to do." Louisa finds it rewarding to be able to provide these opportunities for her students.

Louisa values the emotional aspect that comes with math. She shared math is her favorite subject to teach. She also shared a story that as a student herself, she hated math. She would go home upset every day because of math. She said she thinks she would have enjoyed it more if she had hands-on manipulatives to support her own math engagement. She is excited now to be able to provide a positive math experience for her students and finds it rewarding to have her students engaged in math.

Student ownership of learning (goal setting). In some form or another, teachers discussed they want students to own their learning. Teachers often spoke of setting goals with students to have them track their own progress. When asked about her favorite engagement strategies, Elizabeth said, "I love watching the kids leading activities and lessons. I love watching them do it because you can see the pride in themselves, and it's intrinsic… You can see they're proud of themselves because they're doing it." Later in the interview Elizabeth expressed this idea again and its importance for helping them develop their language skills. She said, "I really want them to own their learning, and I really want them to explain their learning and explain their concepts. So, they're starting to get that language."

Abigail also mentioned wanting students to be cognizant of their academic progress. She said, "…I want you to know where you are and know where you need to get, so you have a goal, and I'm going to… guide you... So, the engagement is… self-awareness of where they are with the standards." She explained that although kindergarteners are young, they understand their own

progress. She shared the example that if a student doesn't meet their goal, she will show them where they need to be and give them steps to accomplish this task. She will then reevaluate students by giving them an addition exit ticket. Once students meet this goal, they will move on to their next goal. She said her students were "constantly goals out" but they knew what they needed to do to accomplish their goals. She explained the importance of students knowing their goals by saying, "That's where the engagement comes in. So, if they… understood more of their path that they need to take, [then] they'll be engaged because they understand the end point is there. And it's accessible." Abigail empowers her students to be self-aware of their progress and works with them to create attainable goals. She also gives students multiple opportunities to be successful.

Natalie explained she will teach students different math strategies then eventually let them decide to use the one that works best for them. She hopes to empower students to think about what will make them successful. Natalie shared she wants her students to choose which math strategies will work best for them. She will say to her students, "…Every day I ask you to use a certain strategy, but in the end, I want you to use the strategy that you like, your favorite strategy. The one that's going to be most efficient for you." She explained they talk a lot about efficiency. She followed this by stating, "I'm just helping them really, just empowering them." Natalie also specifically mentioned she talks to students about their progress and said it's important for students to set goals. She said, "Setting goals with them… That's really engaging because then they get to decide what they want to do better in." She explained she will have students come up with individual goals that they can write in their journal, or it may be on a sticky note that they put together as a class [poster]. She also mentioned she may have students chart their growth on graphs.

Differentiation. Every teacher discussed how they differentiate instruction to support students' needs and/or interests. Teachers discussed strategies to support their on-level, below level, and above level learners. However, differentiation can come in many different forms. Teachers discussed different ways they meet their students' needs.

Commonly discussed were ways to support struggling learners. Charlotte, Elizabeth, Abigail, Natalie, and Louisa discussed they will use manipulatives to support their students that need additional practice opportunities or a concrete model.

Charlotte also said her math program includes a modification packet that will break down the problem step-by-step and it gives students clues for how to solve the problem. She noted she uses the modification packet for students who do not pass the cumulative math test with a score of 70% or higher.

To support above level learners, Charlotte said she will challenge them to dig deeper by choosing one problem to either explain or draw a picture to show how they solved it. She mentioned her above level learners are often quick with mental math but have a more difficult time explaining their thinking.

Elizabeth noted because of her extensive experience as a special education teacher, she differentiates often. She is quite used to differentiating learning and often adjusts the content to meet the needs of her students. She said because she taught special education for numerous years, differentiation comes innately. She can adjust her lesson in the middle of an activity. Elizabeth shared several examples for how she will differentiate instruction. She said, "If I have a child that noise is too loud… then I'll give them headphones. Or if I have some kiddos with some fine motor delays, I'll find some stuff to help them with that." She provided additional example by stating, "If it's a child that's… not understanding… I'll use pictures…, squares, or

something to help them. If they visually need more, or if they have some attention [deficit], it's… going to be based on what the child's need is."

When asked how Elizabeth differentiates for her excelling learners, she admitted that this is more challenging for her since she is used to differentiating going lower instead of higher. She said for her above level learners she will give students choices to create different projects (i.e., make a book, poster, or a different artifact) and can present these to the class.

Abigail embeds differentiation within her students' leveled games. Her games are color-coded so students know which color bag or box game to grab. She also mentioned if students are grasping a concept, she will try to reteach it in a different way. For example, she will present the lesson with different tactile materials such as cubes or play-doh.

Natalie shared she will differentiate instruction by giving certain students manipulatives all the time. She may customize the lesson practice opportunity for her struggling learners, so they are focusing on one specific task. Natalie gave the example that if a student is struggling with building numbers, the child will focus on this task while she continues to teach the lesson. She explained that everyone will receive the main lesson but she will have them work on a different task to catch them up on the skill. She will keep an eye on them and can determine their progress by how they're working and their discussions. Natalie said her goal is to continue to differentiate for her students. She shared, "That's what I really hope to get better at, is really meeting the students where they're at every day."

She also discussed she implements preferential seating during her math instruction. If a few students did not perform well on their exit tickets the day before, she will seat them closest to her on the rug during the math lesson. She will teach the main lesson, but have students work on a different task.

Louisa mentioned her class contains a large range of student abilities. Her students include English language learners, students receiving special education services, on-level students, and gifts and talented students. She said every student has access to manipulatives. For her struggling students, she will have them solve two to three problems instead of the whole problem set. She said she will also spend time teaching them one-on-one and its more hands-on with them.

For Louisa's on-level and above level learners, she has early finisher activities they can work on after they turn in their math exit ticket. She explained the activities are typically more challenging and integrate past content.

Theme 3: Prior Experiences and Preparedness

The teachers shared their instructional decisions to engage students in math are often based on their prior experiences and level of preparedness. They may base instructional decisions off what has worked well in the past, their content knowledge, and their knowledge of their students.

Years of Experience. The teachers shared their instructional decisions are aligned with the numbers of years they have taught, the grade levels they have taught, and their prior experiences.

Charlotte is an experienced teacher of 9 years and has taught both third and fourth grade. Her experience of teaching fourth grade in the past serves her well since she is knowledgeable of where here third grade students need to be by the end of the year. Towards the end of the year, she will spend some time gearing them up for fourth grade by teaching some of the content they will see next year. During the interview she explained, "My kiddos finished… the third-grade sets… So, I challenge them, and we start with the first fourth grade set. Just so they can get a

taste of what it's going to look like at the beginning of next year." Charlotte said her students enjoyed this challenge, and it helped them build confidence and realize, "Fourth grade isn't going to be so bad (laughs)".

Charlotte also said depending on the group of students, some years she can take her math instruction a step further. She explained when she has had a bright group of students, she would challenge them in the way she would her fourth grade students. She may say to her third grade students, "Okay, well in fourth grade, this is the type of problem that you're going to see. So how would you go about solving this based on what we learned today?" Charlotte's experience of teaching fourth grade allows her to level up her third grade instructional decisions when possible.

Veteran teacher Elizabeth who has taught twenty-one years, sixteen of which were spent teaching special education preschool and two years teaching special education kindergarten-first grade, applies her past experiences to guide her decisions. She said, "A lot of what I'm bringing to my general ed classroom are… items from my special education background… That's why there are a lot of strategies… that I find work really well. Just because those strategies work for children."

Abigail is also a veteran teacher of seventeen years and has taught kindergarten, first, second, and fourth grade. She explained that while she is newer to teaching kindergarten, her teammate, Elizabeth, who is "like a fountain of knowledge", gives her a lot of ideas during their weekly Professional Learning Communities (PLC) meetings. She therefore trusts her teammate's experience and knowledge to make instructional decisions.

Natalie has taught five years in second grade. She said a few times during the interview she is "still learning" when discussing the structure of her math lesson. She explained she thinks it takes time and experience to become proficient with engagement strategies. When Natalie was

asked how she decides which engagement strategies to use, she responded with, “I think as you get more and more experience …it just becomes a part of it. …So, I think engagement… takes a lot of experience… the more experience you have, the more natural it becomes.”

Louisa has taught three years. She has taught both second and third grade. Like Natalie, Louisa shared she is a newer teacher and feels she still has a lot to learn. She related her level of experience with her level of confidence. She explained sometimes teaching is more based on her confidence level. She explained if you “fake it” to appear more self-assured, your students won’t know the difference (she said with a smile and laughing). Louisa also said she is willing to try new things. She wants to capitalize on their engagement and is enthusiastic to do something new.

Trial and Error. Both Elizabeth and Natalie noted their instructional decisions may be based on trial and error. Their past experiences of things not going well allow them to modify future lessons. When Elizabeth was asked how she decides which engagement strategies to use for a lesson, she said, “Trial and error. I mean not everything works every time.” She provided the example, “I could have a *great* lesson on paper and a *great* lesson in my head, and we could be doing it, and I could go, ‘Oh, that didn't work out so well. Nope, nope. Not doing that again.’ (Laughs).” She shared she may modify the lesson after observing a lesson does not go as planned.

Natalie shared a similar idea to Elizabeth regarding trial and error. When Natalie was asked how she selects engagement strategies to implement she said, “It's a lot of trial and error. And then from that, it's whichever had the best response, or the response that I was kind of hoping to get out of it… Just seeing what works for us.”

In the Moment Decisions. Charlotte and Elizabeth both shared their level of experience allows them to make instructional decisions in the moment. Charlotte explained her instructional

decisions to engage students can be made based on what is happening in the classroom. Charlotte shared, “Well, it's on the fly. …If you see five of your eighteen students reading a book, you lost them. You need to stop. We need to figure out what's going to get their attention. She followed this up by stating, “You don't have to do handstands in the classroom, but ask them questions, and have them start explaining their thought process or their work.” Elizabeth also shared she will make changes mid lesson if she needs to modify her instruction for her students. She can differentiate on the spot to support her students.

Knowledge of Students. Teachers mentioned their experiences and years teaching allow them to know in the general sense what their students will be interested in, enjoy, or be able to predict how they will respond to certain activities. When planning lessons, Natalie said she takes into account what she thinks her students will like. Elizabeth mentioned she will consider the whole child, such as asking herself, ‘Does the child need movement or a quiet space?’ She will begin the year with her general knowledge of kindergarteners but then as she gets to know her students as individuals better, she will adjust her instruction. The teachers are mindful of their students’ learning styles by offering them different options to represent their knowledge. For example, Elizabeth, Abigail, and Natalie discussed incorporating student choice as a way for students to practice math in a meaningful way to them. Louisa also shared she will customize her math presentations to make it more geared towards her students’ interests and hobbies.

Experience with Math Program. The degree to which teachers are familiar with the district math program can also influence their instructional decisions. Charlotte expressed she is very confident and familiar with teaching the district math program. Charlotte said, “I have the teacher's manual. But I mean, you know, after so many years of teaching, I don't even look at that anymore.” On the flipside, Natalie and Louisa shared their school district adopted a new

math program this year so they are learning. Natalie said, “It’s kind of a learning curve this year because like I said, I taught the same thing for four years.” She also mentioned that because it is their first year using this program, her team created a document to take notes for changes they want to implement for next year to enhance the same lessons. For example, they noted they may need different materials to teach certain concepts. Additionally, Elizabeth and Abigail are familiar with the district math program and will pick and choose which materials and manipulatives to use. They may also supplement with their own materials and math games.

Preparedness. Teachers commented that being prepared is important for making instructional decisions to support student engagement. Natalie mentioned that having materials prepared ahead of time is very helpful to support engagement. She said, “If you can do the prep… just grabbing it, and being ready to go, is probably the most empowering, as far as decision making.” Natalie also shared by having materials ready, she can incorporate student choice for letting students select materials that will work best for them.

On the flip side, Natalie mentioned that not being prepared can be detrimental to student engagement. She commented, “So lack of being prepared is probably the worst. …The thing that can… affect engagement the most, not being ready.”

Louisa said she likes to have hands-on options available and easily accessible for students. She explained by having it ready to go, she can support students if they are struggling to understand the lesson.

Closing for Research Question 1:

In summary, this section addressed research question 1, ‘*What instructional decisions are exemplary teachers making to engage students in the area of primary math?’*. Exemplary teachers’ instructional decisions are influenced by three themes: (1) the school setting and

expectations, (2) students' needs and interests, and (3) prior experiences and preparedness. From these themes, their specific instructional decisions were addressed based on the strategies they implement to support math student engagement. For example, teachers discussed utilizing student choice, movement, hands-on experiences, and utilizing or forgoing the district math program.

Research Question 1A

How do primary teachers define student engagement?

During the interview, teachers were explicitly asked how they define student engagement. They were also asked how they can tell if students are engaged or disengaged in math. Their responses to these questions varied and are addressed in this section.

Often their answers related to aspects of the definition of student engagement utilized in this study (i.e., behavioral engagement, cognitive engagement, and emotional engagement). Table 2 demonstrates the features teachers used to describe or define math student engagement. This section details how each teacher defined student engagement and how they determined if students are engaged or disengaged in math.

Table 3

Features to Describe or Define Math Student Engagement

Features to Describe or Define Math Student Engagement		
Behavioral engagement	Cognitive engagement	Emotional engagement
• Paying attention • Following directions • Participating • Focused on task, exerting effort • Completing math activity • Students may be quiet or loud, still or moving	• Questioning strategies (i.e., higher order thinking) • Answering questions • Students explaining their thinking • Students teaching others • Productive struggle, ability to work through difficult problems	• High interest • Excitement to learn or participate • Happily working towards goals • Fun is a priority, enjoyment of activity • Play-based activities (i.e., games)

around the room (depends on classroom expectations) • Listening to teacher and peers	• Using multiple math strategies to solve a problem • Discussions (i.e., partner, group, or as a class) • Math talks • Active learning (processing information) • Goal setting • Ownership of learning (i.e., student led activities) • Ability to work through difficult problems	• Hands-on learning • Student choices • Motivated to solve problems • Discussions surrounding what students like/dislike, social-emotional check-ins, and growth mindset • Lessons created around student interests and curiosity

Charlotte discussed she wants her students cognitively engaged. She said, "I want them to be more mentally tired at the end of the day than physically tired." For example, she shared her favorite way to engage student is through questioning strategies. When Charlotte was asked how she defines student engagement, she said, "They don't have to love it, but the productive struggle is good for them. They could be really interested in it, and I really like when [they are]." She provided the example that she enjoys seeing her students figure out different strategies to solve math problems. She also likes when they can explain their thinking and teach others.

When Charlotte was asked how she determines if students are engaged in math, she will base it off their understanding of the content. For example, she will play a short video for students that will teach them the math concept. She will notice if students are paying attention or appear confused. If students appear glossed over, she will stop the video and address their confusion. She will say something to the effect of, "Explain the part that you don't understand. Because I don't accept things like, 'All of it'… 'What part *specifically* are you stuck on?" Once she determines what part they are stuck on, they will do a lot of partner talk. They will spend time investigating the problem and having a productive math talk regarding math strategies.

Charlotte can determine if students are disengaged based on their actions. She said if you see students drawing pictures or reading a book during math time, they are disengaged. She said when this occurs, she will follow up with students. She will pull them to the side individually and check in by saying, “I noticed you were reading, so A.) You either know how to do this so well that it's boring to you or B.) We're really lost. Which one is it, and what do you need my help with? (laughs).”

Elizabeth defines student engagement as “their active learning”. She explained the classroom doesn’t have to be quiet. Students might be noisy, move around, or manipulate materials. She did share that for some students however, it could be them sitting quietly. She said, “It’s about their learning. It’s them processing and learning the skill and the content.” Her definition acknowledges engagement will look different amongst her students. She shared engagement is a high priority in her classroom. She explained the more engaged students are in the learning, the more they will understand. She followed this statement with, “The more they understand what they’re learning and why, and how it will benefit them, then the more engaged they will be and the more apt they will be to want to learn.”

Elizabeth shared she knows students are engaged in math based on observation, questioning, and answering. She mentioned she intentionally will keep her small groups short in length (5-8 minutes) so her lessons can be focused on one specific skill. She notices her students’ attention dwindles if her small groups are 10-15 minutes in length. She said at that point they will start talking and do other things.

Elizabeth can tell if students are disengaged based off their behaviors. She laughed and shared examples of students playing with materials instead of using them for mathematical

purposes. For example, students using pencils as swords, rulers as light sabers, or throwing blocks across the room. When this occurs, she will redirect students.

Abigail relates her definition of student engagement to cognitive and emotional engagement. She defines student engagement as "when students are happily willing to work towards their goals". She explained she wants to make learning fun for them as they are working towards goals. She tries to have games for her students to play to practice math standards. She also said it is important students are self-aware with how they are performing with state standards. She will spend time with students going over their progress with them and creating a plan for them to achieve their goals.

Abigail said she can tell when students are engaged because they are excited about something or want to keep playing the same game repeatedly. She explained engagement will sound like a dull roar, it's not quiet but it's not too loud. It's when she sees students talking and working. She can also tell if they are engaged by the quality of the work they are turning in to her.

Abigail explained she can tell students are disengagement in math if they are not participating. She gave the example that she had one student that was so frustrated by the district math computer program she would just sit there. She wasn't disruptive, but she would just zone out the world around her. When Abigail would try to help her, she said the student didn't seem to care, she really disliked the computer program.

Natalie shared her definition of student engagement relates to students being excited about math, students getting to make choices with how to solve problems, and when students can explain to Natalie what they learned. She said she tries to provide her students with as many choices as possible. For example, students will draw or build their math knowledge. She tries to

honor their special requests regarding how they want to demonstrate their understanding. Students also have a math menu and the opportunity to make decisions for which math activity to complete.

Natalie also mentioned an aspect of behavioral and cognitive engagement. She shared she has some students who are quick when it comes to math. To keep them engaged, she will have students show her a different strategy to solve the problem. She also said she knows students are engaged when they're following directions and doing what they are supposed to be doing. This relates to behavioral engagement in that students are physically on-task and cognitive engagement since they are asked to dig deeper in their thinking.

Natalie explained she can tell students are engaged based on their level of excitement and participation. She said students will be enthusiastic when it is time for math. She said, "I definitely know they're engaged in the whole group lesson. Because they're excited, they're working together, and they're excited to share with the group. That's pretty easy to tell." Natalie said they have math talks and she can determine their engagement based on the discussions happening.

Student disengagement is apparent in their body language. Natalie said she will see physically see it. For example, she will realize students aren't listening. She explained when this occurs, she will ask herself, "What do I do next?". She will also have discussions with her class in the moment. She said she will address caring about learning but also, she will listen to them to learn what they like and don't like about math. She noticed that as her students have become more proficient with math, they have gotten better because their confidence is increasing.

Louisa defines student engagement in relation to ownership of learning and motivation. She said, "I think my definition would be more student-led. I present the objective for math, and

they kind of already have their own idea behind it or can kind of put together an idea." She explained students may be working on the math problem together or by themselves. She followed this up by saying, "…And they are motivated to solve the problem at hand. And so, I feel like that is a telling sign of student engagement, when they *want* to solve it, not just because they have to."

Louisa maintains student engagement by doing a couple check-ins where students will share out to the class. For example, she will pull popsicle sticks with students' names on them. She said, this strategy "keeps everyone on their toes as far as paying attention". She can determine if students are engaged based on observing the learning environment (i.e., her classroom). She explained she can tell based on the conversations students are having if students are engaged or disengaged.

When students are disengaged, Louisa said their body language is a huge telling sign. She explained she has students move around or rotate to different areas during math instruction. For example, students will work on a math problem at their tables then transition to the rug for a different problem. She said if she sees students laying on the ground or having off-topic conversations, she has the mindset of, "Okay something's missing, …it's not making sense to them". When this occurs, she will switch gears and go about the lesson in a different way. She may pull out manipulatives to engage students in a hands-on activity. She said laughingly that she doesn't want to to be talking to only a few engaged ears.

Research Question 2

What changes, if any, to district-provided instructional materials are exemplary teachers making with the intention to enhance student engagement in primary math?

Amongst the teachers, there was a range regarding changes made to district-provided instructional materials. Teachers varied from adhering to the district math program with minimal changes to teachers changing nearly every aspect. Teachers were asked what changes they are making with the intention to enhance student engagement in math. This section addresses the changes, or lack thereof, and why teachers are making these instructional decisions. Teachers also shared what they like and dislike about their specific math program. Learning about teachers' likes and dislikes for their respective math programs give a better insight as to why they may change or implement lessons with fidelity.

Interestingly, the level of creative control corresponds with the degree to which teachers make changes to their district math programs. Table 2 highlights the amount of creative control teachers described they have, and the changes they make to their district math program. For example, Charlotte expressed she has minimal creative control and made minimal changes to the district math program. On the other end of the spectrum, both Elizabeth and Abigail shared they have a significant amount of creative control. Both these teachers discussed major changes they make to the district math program. Natalie and Louisa fell more in the middle of the range. Both teachers described they have some creative control, and each described some changes they make to the district math program. Similar to research question 1, the theme of the school setting impacting instructional decisions may also relate to changes teachers are making to the district math program. Each teacher's changes to the district math program and their reasoning for doing so will be described in further detail.

Charlotte expressed she makes minimal changes to the district math program. Her math lessons focus on using the district math program materials and manipulatives. She shared with this specific math program it doesn't allow for the teacher to skip lessons because it spirals. She

did share that if most of the class is misunderstanding the content, she will pause the district math program lessons for a day or two and reteach using supplemental materials of her choosing. She may use a strategy she remembers performing as a child that helped her understand or use materials located from the website Teachers Pay Teachers. Once students understand the content, she will resume the district math program. When Charlotte was explicitly asked what changes she makes to the district math program she said, "I don't really do a lot of altering."

When asked what she likes about this program she shared she initially was not fond of the program. She said, "At first, I hated it. The first few years I taught it. I thought, 'This stuff goes all over the place, … these kids are never going to learn… this if we don't do it in chunks at a time." With time, she grew to really enjoy the district math program. She added, "But I love the fact that it spirals, and I don't want us to get rid of it (laughs)… I've learned over the years that because it spirals that way, they're continually practicing these problems."

When Charlotte was asked what she does not like about the district math program she explained she does not like that because of the way questions are worded on standardized testing, she will need to supplement to better prepare her students for testing. She also mentioned sometimes the problem-solving questions can be too abstract for a third grader. She gave the example that students were asked a question recently about volume that was far too advanced for students just beginning to learn about volume. In this circumstance, she will add in a physical model so students can see what is happening. She is not necessarily making changes to the math program but will add visuals and concrete objects as needed.

Another change she may implement is allowing students to work together on the cumulative test. She acknowledged there are two cumulative tests in third grade that students tend to struggle on because they do every year. Since these two tests are more difficult, she will

let students work with a partner. Again, she is not necessarily changing the district math program per se, but is making modifications to support student learning.

On the other end of the spectrum, Elizabeth shared she makes a significant number of changes to the district math program. She shared she rarely uses the district math program and has had conversations with her principal about using a play-based and hands-on approach instead for her kindergarteners. Elizabeth justified her creative control by sharing her students have performed well on end-of-year assessments. She has creative control to select math materials because they have scored well. She said, "I think [my principal] gives me a little bit more leeway because I've demonstrated the methods that I'm using are working." She explained she does not need to use the district math program but does follow state standards, the district curriculum road map, and makes sure lessons are appropriate for her young learners. She said she was told the district math program is a tool and is welcome to use it as she sees fit. Elizabeth said, "I'll go through the lessons, and I'll find the hands-on activities. But I do not use any of the worksheets or workbooks." Elizabeth prioritizes making learning hands-on. She explained kindergarteners need to be able to hold manipulatives and move items around. She shared she uses a lot of different items such as counting bears, blocks, and everyday items such as books and water bottles.

Another noticeable change is Elizabeth said the district math program is geared towards whole group teaching. She said, "I might modify [district math lessons] so it's more small group. I might modify it to meet the needs of my kids… or I might not do it at all." Elizabeth will determine if she wants to use a particular math lesson from the district program or she may forgo it altogether and use different materials. She said she also likes to incorporate math and art or may use resources from Teachers Pay Teachers. Elizabeth shared with materials from Teachers

Pay Teachers, she will pick and choose what she wants to use and won't necessarily use it with fidelity.

As far as aspects of the math program Elizabeth enjoys, she said she liked the manipulatives that are provided. She uses the number charts, number cards, and hands-on manipulatives. She shared, "I think the manipulatives are good, the hands-on experiences for the kids. They have a few of those that are really good in there that they could do."

Regarding aspects of the district math program Elizabeth does not like, she shared she did not care for the student workbooks. Elizabeth shared when she first moved to the general education kindergarten classroom, she gave the workbooks a try. She thought to herself, "Okay, they must know something more than I do. Not to use hands-on, but to use a workbook. So [I'm] just going to give it a shot and try it." She then shared, "I tried it, and it's just they weren't engaged. They were just scribbling. They weren't using it. They didn't really get it." Elizabeth questioned this idea of using workbooks and thought to herself, "Am I going to spend time teaching them how to do a workbook page? Or am I going to spend time having them grow their brain, …learn, …gain these concepts, … think for themselves, and… understand it?" Elizabeth shifted her math instruction to using a hands-on approach with games, small group instruction, and student choice.

Abigail's perspective on making changes to the district math program is similar to Elizabeth's. Abigail will use the district math program as a reference to pull resources from, but predominantly pays attention to the standards to builds lessons and create math games. Like Elizabeth, Abigail has a significant amount of creative control when it comes to instructional decisions regarding math. She shared her students scored in the nineties on end-of-year final

assessments, so her students were proficient. Abigail uses her creative control to make changes to the district math program.

When asked how she uses the district math program, Abigail said, “We try, and sometimes it's difficult to find a good match to the priority standard that the district has already laid out… whatever we could find in the program that would match, we used.” Abigail incorporates partner games, a math menu for students to select practice opportunities, and plenty of manipulatives in her instruction.

A major change Abigail makes to the district math program is creating more play-based math opportunities. She will look at the district math program materials, the standards, manipulatives, and build games around the learning objectives. She explained she wanted her students to experience a more play-based approach than what the district math program offers. She said the program was setup as, “… Here's the script. Turn the page. Here's their worksheet. Turn the page. …That just wasn't as play-based as we would have liked it to be in kindergarten. So that's where we struggled. There wasn't a lot of play involved.” She followed this idea by saying, “…We would rather them learn through play at that age, just being developmentally appropriate instead of staring at a worksheet and a workbook”. Abigail said she would look at the workbook and skip multiple pages at a time just to find a page that would work well for their students. She did not want students to be “…staring at a worksheet everyday”. She said, “…At five, they need to have hands-on. They need to have play. They need to know that math is all around them, not just in this book… you’re going to see it everywhere.” Abigail made it a point to have students engage with math in a meaningful way outside of the workbooks. She shared students enjoyed graphing every day and using a variety of math manipulatives. She wanted to

change things up as to not have students think ‘we always use cubes to count’. For example, she may have students work with dice, cards, erasers, play-doh, popsicle sticks, or rekenreks.

When Abigail was asked what she likes about the district math program, she shared the online district math program is engaging. She explained the online program provides error-analysis problems. The character in the game will make mistakes and students will figure out the errors and fix it. Abigail said the students liked the main character that is always making mistakes.

Abigail also shared what she did not like about the district math program. She said she likes about 10% of the program, “… it’s not my favorite”. She explained she did not care for some of the processes the math program uses to solve problems. For example, the district math program teaches number bonds in a unique way. Abigail explained students need to be familiar with number bonds because they will see them in their math career. She said she wishes number bonds were presented in a more streamlined way.

Natalie shared she has some creative control when it comes to teaching math, but overall feels more comfortable using the district math program. She said, “…I really make it a point to follow [the district program].”

She implements some changes but at the core of her instruction utilizes the district math program. Natalie said, “I use the teacher book a lot… The students have a workbook that they use in the classroom and then they also provide a homework book, but my school doesn’t assign homework.” She explained her school is a “no homework school”, except for reading twenty minutes nightly and playing math facts fluency games.

Natalie makes some changes such as incorporating student choice (i.e., letting students use different manipulatives, or draw or build their math problems.) She is also learning and

implementing new engagement strategies this year. She shared this year she learned to have students really engage with anchor charts. She explained her anchor charts will be focused around a content area (i.e., addition). As students learn about the content, they will add vocabulary words or strategies to the charts and have a discussion around their learning. Students will copy the anchor chart in their own journals, so they have the information. She explained it has been fun experimenting this year and rewarding to watch students refer to their anchor charts in their journals. She shared she will also use it when they debrief the lesson such as asking students, "Use as many words as you can from the anchor chart, how would you describe the lesson?". She explained this approach really has students thinking about math vocabulary.

Another change Natalie may implement is spending more or less time on a specific math strategy. If she realizes a strategy may be confusing or only a few students will use it, she will spend less time on it. She will alternatively spend more time on strategies students like to use.

Natalie shared this is the first year they are using this specific math program, so it has been a learning curve. She shared her team has an on-going page of notes where they document changes they want to make to the math program for next year. They will use their knowledge of teaching this program for the first time to make necessary changes for next year. Natalie said, "So next year when I see [our notes], I'll be like, 'Oh, I have to come up with something else."

When Natalie was asked what she likes about the math program, she said, "…There's a lot of choices, and a lot of options, and there's a lot to work with, which I love." For example, Natalie shared the program will have three fluency activities for a lesson. She explained there isn't necessarily enough time to get through them all, but she does have options. She will pick and choose what is most important. To help her remain mindful of the learning objective, she

shared she will write it down on a sticky note. She will also write down the math vocabulary so if all else fails, she knows she taught these specific skills.

Interestingly, what Natalie likes and dislikes about the program align. She said, "…The lessons are relentlessly long… it just goes on and on… pacing is really hard." She likes the options this program provides but realizes for the sake of time, she will need to trim the lesson as she is not able to get through everything. She shared, "When I first started teaching, we would stay on a lesson for three or four days… I thought… the kids had to get it before we could move on... but then you wouldn't get very far on the curriculum." She shared nowadays, "I've learned… that you do have to keep going, and just really figure it out, it's kind of tricky, but you got to figure out those misunderstandings and kind of incorporate that into a lesson." One way she addresses misunderstandings is to share a student's work without revealing their name. She will have students fix the mistake and discuss it as a class.

Louisa shared she implements some changes to the district math program. She explained she used the teacher handbook more as a guide than as a direct script. She shared that because her school focuses on project-based learning, she may change the math lesson to incorporate art, science, or engineering. She enjoys integrating different content areas. Louisa said her students like when she combines areas such as math and art. Her class may create an art project while working on math concepts.

Another change Louisa implements is altering the district math program PowerPoint presentations. She will create her own PowerPoints using the same math concepts, but will customize it to include her students' names in the math problems. She shared she likes to incorporate their interests. For example, she may include a question about soccer since she has students who play the sport. She said, "…Being able to create the PowerPoint based on the

curriculum, or their presentation. It's just I'm able to change some things and make it more geared towards our class." She also said she prefers her PowerPoints aesthetically compared to the math program's presentations. She said, "It's nothing against the curriculum's presentations, I just like how mine look" (laughs)."

Louisa explained she utilizes and likes quite a few aspects of the math program. She said they have "really great math videos that go along with the lessons." She said she will show those to her class. She also uses the problem sets and exit tickets provided by the district math program.

Compared to the last district math program, Louisa shared she prefers the present one. She said, "…The curriculum we are provided, it definitely promotes [engagement] a lot more than the curriculum we've had in the past. The switch was a good decision." She shared it is more user-friendly and does a nice job scaffolding the lessons. She said, "I like that the lessons seem to be more scaffolded within the module so it's not jumping around so much. It's a clear connection between lessons and they're always building off… each other." Louisa prefers the organization of this program compared to the last one.

Additionally, Louisa likes that this program offers a lot of ideas regarding how to differentiate lessons. She shared the program will suggest which manipulatives to use, how to support struggling learners, and how to enhance the lesson for above-level learners. She likes that it "gives the students different ways to interact with the curriculum."

As far as math program dislikes, Louisa shared she wishes it wasn't as scripted. She said, "…It seems like you're listening for something. Whereas I wish it was just more natural. We could build off each other's ideas, naturally, and I wasn't already looking for a certain answer.

It's very scripted." She explained the teacher manual includes a script for the teacher and student responses. Louisa said it gives her an idea of what to listen for, but it does feel a bit too scripted.

Closing for Research Question 2:

This section addressed the research question, '*What changes, if any, to district-provided instructional materials are exemplary teachers making with the intention to enhance student engagement in primary math?'.*

This section included changes teachers make to their district math program. Also discussed were teachers' likes and dislikes about their specific math program and why. This was important to include as teachers are often making changes based on what they don't like about the program or want to enhance.

Overall, teachers differed in the number of changes they make to district-provided instructional materials. Some teachers shared they changed nearly every aspect of the district math program while others make some or minimal changes. The number of changes were often aligned with the amount of creative control teachers have with making instructional decisions. For example, Elizabeth and Abigail made the most changes to the math program and described they have a significant amount of creative control. Both shared they will often forgo the district math program and utilize a play-based approach with math games, small group instruction, and math menus. Natalie and Louisa shared they have some creative control and described some changes they make, but both ultimately utilize the district math program. Charlotte shared she is minimally able make changes to the district math program and closely implements the provided lessons.

Teachers shared what they liked and disliked about the math program. This helped to understand why they are making certain changes. For example, Charlotte shared she likes the

math program which supports her decision to implement it with fidelity. Elizabeth and Abigail do not find the math curriculum to be developmentally appropriate for their kindergarteners which is why they often supplement with hands-on materials. Natalie described she feels more comfortable utilizing the curriculum and makes some changes because she is a proponent of student choice. Louisa said she likes this district program compared to the previous one. She makes changes to better relate the content to her students' interests.

Summary of Research Questions

The interviews and questionnaires of exemplary primary teachers detail how they make instructional decisions to support student engagement in math. To address research question 1, the exemplary teachers described various student engagement instructional decisions they make during their math instruction. Often these decisions are based on their school setting, students' needs and interests, and prior experiences and preparedness. Figure 1 highlights the influences used to make instructional decisions to support student engagement in math. Figure 1 also displays the strategies teachers utilized and their reasoning behind their instructional decisions. For example, teachers discussed using a hands-on approach with many different manipulatives, incorporating student choices, and having discussions to support student understanding.

Research question 1a addressed how teachers define student engagement. The teachers' definitions of student engagement varied, however there were themes of behavioral, cognitive, and emotional engagement interweaved throughout their responses. Table 3 displays attributes teachers discussed to define or describe student engagement.

To answer research question 2, the teachers varied in the amount of creative control they have to make instructional decisions and changes to their district math programs. A continuum was apparent; those who had more creative control made the most changes to the district math

programs whereas those who had some or minimal creative control made some or minimal changes, respectively. Their decisions to change or implement the district math programs are often driven by their likes or dislikes for the math program materials. Teachers also discussed making changes to their math programs lessons to better fit their students' needs and interests.

CHAPTER 5

SUMMARY, DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

This chapter includes a summary of the study, a discussion around the research findings, conclusions are stated, as well as recommendations for teachers, principals, school administrators, and future research.

Summary of Study

This study was conducted to better understand the instructional decisions exemplary primary teachers make to engage students in math. Teachers discussed various engagement strategies they utilized to support math student engagement. Additionally, the phenomenon of teachers altering, supplementing, and/or utilizing their district math program to support student engagement and understanding was studied. The study involved determining the difference between what math resources teachers are *given* and what resources they are *using* to support student engagement. Teachers discussed ways they adhere to the district math program and changes they made to it.

A considerable amount of student engagement research exists. However, the research is largely focused on middle school and high school. There appear to be fewer studies regarding student engagement at the elementary level, and even less research focusing on primary grades (kindergarten-third grade). This study exclusively focused on the primary grades.

Much of the current research surrounding student engagement utilized empirical research methodologies. The research findings from these studies reported quantifiable aspects related to student engagement, such as achievement grades, test scores, and student relationship quality. A lesser amount of student engagement research employed an interpretative paradigm. To

effectively answer the research questions, an interpretative paradigm was considered the best fit for this study.

Case study was the selected methodology because it closely aligns with the purpose of the research. A case study approach allowed the researcher to gain a deeper understanding of primary teachers' instructional decisions to enhance math student engagement. The case study was also bound by both time and place, limiting participation.

Five primary teachers participated in the study. The participants taught kindergarten, second grade, or third grade. The teachers taught at three different schools within two different school districts. Each educator shared a unique perspective as to how they supported math student engagement.

Purpose of the Study

The purpose of this study was to explore and gain a deeper understanding of instructional decisions exemplary primary teachers made in order to engage students in math. Teachers described the math student engagement strategies they implemented and their reasoning for their decisions. Additionally, a secondary focus for this study was examining the changes teachers made to district-provided instructional materials with the intention to enhance math student engagement. This involved determining the math resources teachers were provided, the math resources they implemented, and their reasoning for their changes or adherence to the district program.

The study was comprised of three research questions:

1.) What instructional decisions are exemplary teachers making to engage students in the area of primary math?
    a. How do primary teachers define student engagement?

2.) What changes, if any, to district-provided instructional materials are exemplary teachers making with the intention to enhance student engagement in primary math?

Study Design

This case study was situated within an interpretative paradigm. The focus of this study aligned with interpretivism as the goal was to understand, describe, and interpret how primary teachers enhance math student engagement in their classrooms. The primary teachers shared their lived experiences and presented multiple perspectives.

Prior to collecting data, a bracketing interview was conducted. The purpose of the interview was to address prior beliefs and held biases of the researcher in relation to the study. This meeting was conducted by a college of education professor knowledgeable of bracketing interviews. This interview served to illustrate the researcher's positionality within this study.

A pilot study was implemented prior to data collection. The researcher asked three former colleagues to participate in the pilot study. They agreed and went through the process participants would be asked to follow. Each subject met the requirements to participate. They were sent the materials associated with the study (i.e., recruitment email, informed consent document, and questionnaire), and each participated in an interview. They also had the opportunity to review their transcripts after the interviews. Throughout the process, the teachers gave feedback and helpful suggestions. This allowed the researcher to refine the study's process.

The participants for this study included five primary teachers deemed 'exemplary' by their principals, school senior figures, or colleagues. Additionally, each teacher self-reported that they received above average ratings on their annual teacher evaluation in the area of student engagement. The primary teachers taught in the American Southwest. Teachers from three different elementary schools within two school districts were represented in this study. The

teachers ranged in age from late twenties to early fifties. All five teachers identified as female. Their years of experience teaching range from three to twenty-one years. At the time of the interviews, the teachers taught either kindergarten, second, or third grade. Four of the five teachers reported they have had experience teaching at least two different grade levels. Collectively, the teachers have taught preschool, kindergarten, first grade, second grade, third grade, and fourth grade. Additionally, one teacher taught special education preschool and special education K-1.

Purposeful sampling was utilized to work with teachers that met the criteria for participation. Upon school district approval, principals were contacted to nominate three primary teachers that fit the study's participation requirements. From this list, one teacher was contacted at random. If this teacher chose not to participate, a second teacher at random was contacted. If the second teacher also chose not to participate, the third teacher was contacted. If the third teacher declined, the researcher contacted different principals and teachers.

Later in the study, an amendment was added to include snowball sampling (noted in changes in Appendix A). This allowed the researcher to ask participating teachers if they knew of a colleague who might be interested in participating in this study. This measure was added to increase teacher participation. Snowball sampling proved beneficial as one teacher signed on to participate through this recruitment approach.

Teachers were contacted via email and/or phone for participation. A recruitment email was sent initially, and follow-up emails or phone calls were made as necessary. The recruitment email provided potential participants with background information, the informed consent document, and the questionnaire. Once teachers signed the informed consent document and

successfully completed the questionnaire (meaning they met the criteria to participate), they were contacted to schedule an interview.

While scheduling interviews, teachers were emailed a copy of the interview protocol. The researcher shared these were the questions the teachers would be asked and provided a list of potential subquestions (see Appendix E). The teachers had the option to review the interview protocol ahead of time if they wished, but did not need to have anything prepared for the meeting.

Interviews were conducted via Zoom. This allowed the participants the flexibility to schedule a meeting time convenient for them. Additionally, this meant the participant and the researcher could be in two separate geographical areas. Interviews took place during the school year, over breaks, and sometimes on the weekends.

With permission from the participants, the Zoom interviews were recorded. This allowed the researcher to transcribe the interviews word-for-word. Teachers were sent a copy of their transcript via OneDrive. Teachers had the opportunity to make changes, add, or modify their transcripts. Once they were done reviewing, they sent the researcher an email stating they approved their transcript. After teachers approved their transcript, they were mailed a thank you note and a $10 Starbucks gift card for participating.

Interview transcripts were used in the coding process. Data were first analyzed using Glaser and Strauss' (1967) constant comparative method. This method allowed the researcher to begin coding data as soon it was collected. Additionally, the researcher was able to compare data and note similarities and differences. Three cycles of coding were implemented: open, axial, and selective coding. Open coding was initially utilized to be expansive in identifying information that may be pertinent. The transcripts were coded individually and collectively to compare

similarities and differences. The researcher spent time examining how each teacher responded to the same questions. Broad categories were formed from the initial codes.

Axial coding involved organizing the categories based on similar findings. Categories evolved in this stage. The original descriptive categories were refined, and subcategories emerged.

Finally, the selective coding process involved identifying connections and themes amongst the categories and subcategories. These themes became apparent to answer the research questions.

After coding was completed, the researcher organized the information into tables, figures, and created an outline of the findings. This captured the major themes and connected the supporting information.

The findings from the research are detailed in chapter 4. Similarities and differences were discussed in relation to the themes. Direct quotes from the participants are weaved throughout to substantiate the connections drawn.

Data triangulation was accomplished through member checking, working with a second coder, and utilizing multiple methods of data collection. Member checking involved participants reviewing their transcript. Participants were given the opportunity to modify (i.e., add, delete, and/or change) or keep the transcripts the same. Once they were done reviewing, the participants emailed the researcher saying the transcript was approved.

A second coder reviewed transcripts separately from the researcher. The second coder was a fellow college of education graduate student not invested in the outcome of the study. The second coder was sent copies of the de-identified transcripts. The codes from the second coder were used to compare against the researcher's codes. This ensured the researcher's

interpretations of the data were aligned with an individual not connected to the study. Similar codes surfaced between the researcher and the second coder.

Lastly, multiple methods of data collection were utilized in this study. Principals and colleagues nominated teachers for participation that demonstrated exemplary student engagement practices. Teachers also self-reported they received an above average rating in the area of student engagement practices. Additionally, data were collected using both a questionnaire and the interview protocol. The two sources of data collection allowed the researcher to compare and check findings against one another.

Limitations

This study utilized a case study design. The case itself limited participation as it is bound by time (2021-2022 and 2022-2023 school years) and place (two school districts in the American Southwest). A limited number of teachers (five) participated in the study. The sample size was small, and findings cannot be generalized.

Another limitation were the requirements to participate. Five requirements had to be met to participate. Participation was limited to (1) general education (2) primary teachers (kindergarten-third grade). The primary teachers (3) had to instruct math during a typical school day as the study focused on math student engagement. The participants needed to be (4) deemed as 'exemplary' by receiving high ratings on annual teacher evaluation forms in the area of student engagement. Since the study focused on supporting student engagement, it was important teachers demonstrated knowledge and skills to be able to impart their expertise. Finally, the primary teachers needed to (5) have some flexibility to choose appropriate math learning materials. This was important as an element of the study was discerning what math materials teachers are *given* and what materials they are *using*.

To add to the limitation above (#3), being deemed an 'exemplary' teacher is a limitation of the study. Potential participants were identified by their principals, senior figures, or colleagues as employing exemplary student engagement practices during math instruction and receiving high ratings in this area on their annual teacher evaluation form. The researcher was dependent on principals', senior figures', or colleagues' understanding and judgement of student engagement practices. A concise definition of what it means to be 'exemplary' was not given to the principals, senior figures, and colleagues. Instead, they were asked to determine teachers' student engagement practices in relation to their district evaluation rubric.

An additional limitation is the selected school districts must be a public school district and have adopted a math program. This math program must be available to participating teachers.

Also, a limitation is the researcher relied on participants to answer questions openly and honestly. This study involved teachers self-reporting their classroom student engagement practices. Teachers self-reported on the questionnaire and during the interview.

The restrictive time frame is another limitation. Interview data were gathered within an eleven-month time frame. Participation was limited to those teachers available during this time period. A longer period of time may have allowed for a larger sample size.

Another limitation involves the study design of having 'one shot' interviews. With a limited time frame for data collection, follow-up interviews were not conducted. Follow-up interviews would potentially allow the researcher to delve deeper in understanding based on initial interview findings. It may have also helped to clarify some of the teachers' initial responses to the interview questions.

Lastly, it is important to acknowledge the limitation that engagement also resides within the child. While teachers play a major role in student engagement, they do not bare the sole responsibility. Rather, students play an integral part in their own engagement. This study does not address student perspectives but instead focuses on teachers' perspectives and practices.

Findings Related to Research Questions

1.) What instructional decisions are exemplary teachers making to engage students in the area of primary math?

A focus of the study was to illuminate instructional decisions exemplary teachers implement in their daily math instruction to support student engagement. The teachers' instructional decisions included employing an assortment of effective student engagement strategies. Some strategies the teachers incorporated are student choices, discussions, hands-on learning, movement, emotional connections, ownership of learning, and differentiation to engage their primary students. Their decisions to incorporate various student engagement strategies were influenced by three noticeable themes: (1) the school setting and expectations, (2) students' needs and interests, and (3) prior experiences and preparedness. The school setting and expectations impacted their instructional decisions because teachers had to work within a certain framework. For example, participants shared they were required to follow state standards. Three teachers expressed they were required to use the district math program, whereas two teachers shared it could be used as a tool. Instructional decisions relating to students' needs and interests highlighted different student engagement strategies. For example, teachers discussed ways they differentiated instruction to support their students understanding and engagement. Lastly, prior experiences and being prepared influenced the teachers' instructional decisions. Teachers used their prior knowledge from their years of experience to plan lessons. For example, they were

mindful of what students enjoy, where students need to be academically by the end of the year, and were prepared to differentiate at a moment's notice.

1a.) How do primary teachers define student engagement?

Teachers were asked to share their definition of student engagement. Participants were mixed in their responses. Their personal definitions related to aspects of the definition utilized in this study. The teachers discussed elements of behavioral engagement, cognitive engagement, and emotional engagement.

2.) What changes, if any, to district-provided instructional materials are exemplary teachers making with the intention to enhance student engagement in primary math?

A separate focus of the study was to learn what changes, if any, primary teachers made to their district math program. Teachers described their amount of creative control as it related to making changes. Some teachers discussed adhering to the district math program while others made significant changes. Their described level of creative control impacted how much content they changed. Teachers who shared they had a great deal of creative control made the most changes. Comparably, the teacher who shared she had minimal creative control described making the fewest number of changes. The teachers explained they made changes based on aspects they disliked about the math program or ways to enhance it. Conversely, teachers shared they did not make changes because they liked the district math program.

Summary of Findings

Similar to previous research, most teacher participants shared the importance of student engagement in the primary grades (Brouillette et al., 2014; Guo et al., 2015; Luo et al., 2009). Teachers described making conscious and concerted efforts to engage their young learners in

math. Most of the participants discussed intentionally planning lessons to increase engagement. Additionally, most teachers shared they adjusted their lessons in the moment to support student engagement. They may have observed students were struggling and adjusted their pace or added manipulatives to support student learning and engagement.

Student engagement is not one-size-fits-all. The research demonstrated a wide range of student engagement strategies that may benefit young learners. Similarly, the participants discussed a variety of student engagement strategies they implemented. The teachers varied in their approach to engage students. The teachers highlighted their favorite engagement strategies to be questioning, student choices, play-based learning, and making cross-curricular connections. Student engagement practices took many forms and were customizable to fit the teachers' instructional decisions and students' needs and interests. The strategies discussed by teachers were also reflected in the research. The use of game-based learning (Partovi & Razavi, 2019; White & McCoy, 2019), manipulatives (Carbonneau et al., 2013), and movement (Bartholomew et al., 2018) were noted in several studies.

A definition of student engagement has not clearly and unequivocally been defined in the research. However, a common definition involved viewing student engagement as a multidimensional construct involving behavioral engagement, cognitive engagement, and emotional engagement (Fredricks et al., 2004). The teachers described their personal definitions of student engagement. Their definitions varied which may not be surprising, since a clear definition in the research is not established. They discussed attributes of behavioral, cognitive, and emotional engagement, but did not explicitly use these terms.

Most teachers reported they made some or significant changes to their district math programs with the intention of enhancing math student engagement. Teachers stated they would

alter the district math program based on certain dislikes or to better support students' needs and interests. For example, two teachers wanted their math instruction to be more play-based and hands-on, so they omitted using the math workbooks. Other teachers explained they used the district math program as a guide and cut out areas that were relentlessly long or too scripted.

Sometimes changes to the district math program were not drastic. Each teacher explained they added manipulatives as needed to support learning and engagement. In this instance, they were not necessarily altering the math program, but were extending the lessons to differentiate or support their students' understanding.

A noticeable trend in this study is the influence school settings had in relation to instructional decisions. Teachers discussed their level of creative control. Two teachers at a neighborhood school explained they had a significant amount of creative control, two teachers at a magnet school mentioned they had some creative control, and one teacher at a traditional school expressed she had minimal creative control over selecting math materials and lessons to teach. Depending on the school setting, teachers were expected to adhere to the district math program, or had some to a significant amount of creative control to select math materials.

All participants shared to some extent their instructional decisions were influenced by their past experiences. Teachers explained they use their knowledge of students and years of experience teaching (i.e., teaching different grade levels, special education, or even the same grade level) to make instructional decisions. They were mindful of what lessons had and had not worked well in the past in order to recreate or enhance their teaching practices.

Additionally, three teachers mentioned the importance of being prepared. By having materials ready, they were able to make adjustments (i.e., immediately use manipulatives) in a moment's notice, or were able to provide their students with more options for learning the math

content. For example, one teacher mentioned having materials ready so students could choose if they wanted to build or draw their understanding of the math content.

Two participants related engagement to achievement. The teachers explained their students performed well (in the nineties) on end-of-year assessments. They both attributed this to their math structure of using a play-based, hands-on approach to learning. Other studies have found a strong link between engagement and achievement in the primary grades (Bodovski & Farkas, 2007; Luo et al., 2009).

Discussion of Findings

A surprising finding is the extent to which the school setting shaped teachers' perceived amount of creative control and instructional decisions. A range became noticeable that teachers expressed they had minimal, some, or a significant amount of creative control. Teachers with the most creative control made the most changes to the district math program. On the other hand, the teacher with the least amount of creative control made the least number of changes. The two teachers that fell in the middle of the range shared they used the math program as a guide. They made some changes to fit their students' interests. One teacher shared she attempted to incorporate student choices as often as possible.

Teachers in this study stayed within their perceived limits of instructional decisions when it came to making changes to the district math program. Yet their reasoning for these changes is important to acknowledge. Teachers explained they made these changes to enhance student engagement, pique their students' interests, and ultimately support student learning.

The teachers discussed a myriad of instructional decisions to support student engagement. Their decisions often aligned with their creative control. A noticeable pattern occurred in that the teachers that had a significant amount of creative control thus gave their students more autonomy as well. The teachers with a significant amount and some creative control shared they were

flexible in their approach to learning and elected to give their students as many options as possible. They discussed they incorporated flexible seating, as to let students pick where they wanted to work and be successful. They also included math menus to allow students to select an appropriate math game to practice. Additionally, they gave students more choices to demonstrate their knowledge in a meaningful way. For example, students were given the option to draw, build, or use manipulatives to solve math problems. The teachers also incorporated 'quick writes' where students solved problems by drawing or writing and had the opportunity to share with the class how they arrived at their math solution. The findings suggest the culture of the school regarding creative control can trickle down to students. In these classrooms, students were empowered to make choices.

The student engagement strategies teachers discussed implementing were well documented in the research (Dyrstad et al., 2018; Uribe-Flórez & Wilkins, 2017; Vankúš, 2021). The engagement strategies commonly discussed amongst the participants included hands-on experiences, student choices, movement, discussions (collaborating and questioning), emotional connections, ownership of learning (i.e., goal setting) and differentiation. The teachers described benefits of these strategies to support engagement and student learning. Past research has drawn similar conclusions regarding the significance of student engagement. Engagement and math achievement have been strongly linked in previous research (Baroody et al., 2016; Bodovski & Farkas, 2007; Luo et al., 2009).

An interesting finding is apart from one teacher, teachers did not directly mention teacher-student relationship quality or peer relationship quality. Relationship quality amongst peers and teachers-students were commonly found in the research as enhancing student engagement (Hamre & Pianta, 2001; Hughes et al, 2008; Rudasill et al., 2011). One teacher

mentioned she worked to build a classroom community amongst her students. The class would have discussions about what they liked and didn't like when it came to math.

Another teacher shared she incorporated a social-emotional check-in at the beginning of the day. It is assumed this check-in allowed the teacher to better connect with students emotionally, but the conversation did not unfold into discussing this further. Teachers discussed peers working together to support their understanding of the math content, but did not specifically mention building peer relationships. This is not to say the participants do not value teacher-student or peer-relationships, however it was not explicitly mentioned. This could be due to the line of questioning not eliciting a response relating to relationships or perhaps it was assumed. Every teacher shared she valued collaboration and math discussions amongst peers. Thus, teachers embedded peer interactions in their math structure. Additionally, the teachers selected engagement strategies based on knowing their students' abilities, needs, and interests. Teachers often shared they would select activities they anticipated the students to find fun and exciting.

A notable finding is participants were mixed in their delivery of instruction. Four teachers predominately taught math using a whole group approach. One teacher primarily utilized small group instruction but would start her math instruction with a short (5-7 minutes) whole group lesson just to introduce the math concept. The teacher that utilized small group instruction viewed it as an opportunity to differentiate instruction. For example, a group of students might have worked on numbers to ten while a different group worked on numbers to twenty or higher order thinking skills.

Some teachers explained they used small group instruction on an as-needed basis. That is, they worked with students individually or in a small group if they noticeably needed support or

were struggling. In this sense, small group instruction was used more as an intervention. Additionally, the teachers shared they did not have set groups. They explained the groupings were fluid. The student groupings varied based on the specific skills. Teachers more so mentioned working with students in small groups that were struggling as opposed to on-level or above-level learners. Similarly, Hollo and Hirn (2015) found whole group instruction to be the most common grouping amongst all grade levels. However, small group instruction was most prevalent in elementary schools compared to high schools and middle schools.

Lastly, an important finding to point out is teachers' attitudes when it came to math. Past research stated teachers with positive attitudes are associated with teacher effectiveness (Palardy & Rumberger, 2008) and also encouraged student initiative and independence (Karp, 1991). The teachers in this study shared positive feelings towards teaching math. One teacher shared she found it rewarding to see students make connections and be successful in math. Additionally, the participants shared they felt supported by their principals. One teacher mentioned she was praised for her questioning techniques by her principal, which is an engagement strategy she shared she utilized most often. A different teacher explained she has had conversations with her principal about her math instruction. Her professional judgement was trusted. Additionally, one teacher said she felt supported and encouraged by her school administrators to try new strategies and implemented project-based learning. The teachers' positive attitudes may be partially attributed to feelings of support from administrators. The participants were treated as professionals and knowledgeable of supporting student learning.

Conclusions

The importance of student engagement supporting learning is often accepted by researchers, school administrators, and teachers. However, what student engagement means and what it looks like presents a difference in opinion. Similar to previous research, teachers in this study presented a

multitude of student engagement definitions. Since student engagement means different things to different people, instructional decisions to support engagement will inevitably vary. Some teachers described student engagement as being emotionally connected to the content (i.e., enjoying math, relating the concepts to students' interests, incorporating student choices) while other teachers related it more so to cognitive engagement (i.e., discussions, collaboration, and working towards goals).

It became apparent in this study teachers' instructional decisions to support math student engagement are largely influenced by the school setting and expectations, students' needs and interests, and prior experiences and preparedness.

It is the researcher's opinion that school districts administrators and principals should allow teachers the creative control to make instructional decisions that are best for their students. While a district math program may be a helpful tool, it does not account for each students' unique needs and interests that teachers experience on a daily basis. Teachers should therefore be given the professional autonomy to make instructional decisions that meet the standards and support their students. Moreover, school district administrators and principals should be considerate of the messaging being sent to teachers regarding expectations when it comes to adhering to or having creative control to decide what is best for students.

Ultimately, most of the teachers expressed being intentional with implementing student engagement strategies. They structured their math lessons and use of materials to support engagement. Additionally, they shared strategies for reducing disengagement. Teachers described making decisions or changes if/when students became disengaged. They could recognize signs of disengagement, such as shifts in behavior or if students withdrew cognitively. They were mindful of their students' needs and added manipulatives, movement, or choices to reengage students. This is important to highlight as the findings suggest teachers were constantly having to make instructional decisions. Not only were they teaching, but they were also monitoring and assessing different aspects of student engagement. This notion that teachers were continuously making instructional decisions

supports the idea that teachers need to have creative control. Teachers were able to account for necessary changes that were not specifically addressed in their math programs. For example, they realized they needed to reteach a concept for students to move forward. Conversely, at times students required enrichment activities to take the learning a step further. In this instance, strictly adhering to a math program would have stifled learning opportunities. Teachers understood their students' needs, interests, and abilities and were able to individualize learning that otherwise may not have been offered in their district math programs.

There are a multitude of strategies to support math student engagement. The variety of student engagement strategies discussed by the teachers acknowledges the fact that students may exhibit different learning styles and needs. The engagement strategies they discussed implementing are also reflected in the student engagement research. They varied in their approach yet shared the goal of supporting student learning.

The teachers shared they implemented an assortment of strategies to best reach their students. For example, some students needed a quiet learning environment, so they were given headphones to cancel out sound. Whereas other students required movement or manipulating tangible items to be successful.

Some teachers made it a point to include physical activity in their lessons. Three teachers shared they incorporated movement such as having students rotate around the room, go touch shapes around the room, or hop from number to number. Research supported the use of purposeful movement (Bartholomew et al. 2018, & Synder et al., 2017). Snyder et al. (2018) cited Tranquillo (2008) in stating, "Purposeful movement may be an effective strategy for targeting the kinesthetic learner, considered to be the dominant learning style for the majority of primary-aged children" (p. 76). Kinesthetic learning includes touch, physical movement, and hands-in approach. Each of these strategies were commonly discussed amongst all the participants.

Another common strategy was incorporating student choices. Three teachers explained they incorporate student choices. They let students select the math activity they would like to work on from a math choice board. Baten et al. (2020) and Reeve & Cheon (2021) agreed building in student choices is one way to be an autonomy-supportive teacher. Incorporating student choices validates the students' perspectives (Baten et al., 2020).

Another major theme in this study is teachers made instructional decisions based on past experiences and preparedness. The participants utilized their experience of what has and has not worked well in the past, their understanding of students, and their knowledge of the curriculum and standards. The participants' teaching backgrounds varied. Some were veteran teachers of close to or over twenty years' experience while others were relatively newer to the field of teaching with less than five years of experience. Additionally, four of the five teachers have taught multiple grade levels and one teacher had an extensive background in special education. Their prior experiences influenced their decisions as they were cognizant as to what works for students. They discussed they made in-the-moment decisions to best support their students. They were prepared to make changes and diverted lessons as needed.

The findings from this study suggest teachers were reflective in nature. They were critical of their past lessons and strived to improve their upcoming lessons. One teacher shared her team created a running list of changes they wanted to implement with the district math program for following school year. Teachers in this study were continuously gathering new ideas and relying on past experiences to inform their decisions.

Overall, the three constructs of student engagement (behavioral, cognitive, and emotional) were apparent in the research findings. Teachers shared their experiences of enhancing student engagement which directly related to these aspects of engagement. The research suggests the participants had a great deal of influence in the classroom. They had the

opportunity to support students' learning and implement instructional decisions to enhance student engagement.

Recommendations

Based on the findings in this study, the researcher has developed recommendations to further support math student engagement in the primary grades. The recommendations are related to the participants' experiences and influences of enhancing student engagement in their own primary classrooms. The recommendations include practical implications for teachers, principals, and school district officials.

Recommendations for Teachers

Since a great deal of research reveals the significance of student engagement in the primary grades, it is important teachers are actively implementing student engagement strategies to support their students in understanding mathematical concepts. The researcher encourages teachers to be mindful and intentional with engagement strategies when planning math lessons. Teachers may wish to reflect on their current engagement practices and expand their techniques. The participants discussed their engagement strategies relate to their students' needs and interests. Teachers may need to consider their own students' abilities and goals to differentiate their engagement strategies to best meet the needs of the learners in their classrooms. The researcher recommends utilizing the engagement strategies discussed by the participants. The engagement strategies include incorporating movement, hands-on learning, student choices, discussions, differentiating, student ownership of learning, and creating emotional connections.

Recommendations for Principals

The participants discussed their instructional decisions relating to student engagement are often related to the expectations set out by their principals. The teachers expressed varying

degrees of creative control when it came to the district math program. A notable range existed amongst the participants of having to either adhere to the district math program or having had a significant amount of creative control to decide which materials to use. Therefore, the researcher recommends principals be mindful of the expectations they set with teachers regarding the use of the district math program. Principals may wish to reflect on how their school practices are supporting student engagement.

Additionally, the researcher recommends principals remain open and support teachers wanting to try new approaches such as creating cross-curricular connections or project-based learning that may not be found in a district program. Teachers wanting to go above and beyond to support learning and engagement should be supported. Moreover, the teachers may be able to share their experiences with colleagues at the school and inspire others to try different engagement approaches as well.

Principals may wish to schedule time to meet with grade level teams to have open conversations regarding instructional decisions and student engagement practices to support student learning.

Recommendations for School District Administrators

Math programs purchased by school districts are often costly endeavors. School district administrators may spend a lot of time and money deciding on a program that best fits their students. Based on the participants' varying use of their district math programs, it is important school district administrators consult teachers when selecting materials as they are the ones implementing the selected program. Giving teachers a voice in deciding the math program may support more teachers utilizing the selected materials.

Additionally, it is essential school administrators ensure the selected math programs align with current state standards. If in fact school district administrators expect teachers to adhere to a certain program, it gives more reason to choose wisely when selecting an appropriate math program. Math programs have the potential to control instructional decisions. Teachers may enact math programs with fidelity, following the provided script and/or going from page to page in a teacher's manual without making changes.

Ideally, teachers should be given time throughout the school year to meet with their grade level team to connect state standards to the available district math programs. Teachers could use the time to decide which lessons best meet the standards, compile suitable activities, and determine ways they may need to differentiate instruction for their students.

Recommendations for Future Research

A vast amount of research involves student engagement. However, a good portion of the studies involve high school and middle school. Much less research involves studying primary grades. Therefore, more student engagement research is needed concerning the primary grades. Student engagement research in the primary grades is beneficial as Ladd and Dinella (2009) found primary students who demonstrated higher behavioral and emotional engagement made greater academic gains than students with lower levels of engagement.

While this study focused on teachers' perceptions of instructional decisions to support student engagement, a key voice could be included in future studies, the students. Future studies could involve asking primary students about their own engagement and connectedness to math. The participating teachers shared their students are vocal about what they like and dislike about math and have the ability to recognize their current math performance and create goals. In future studies, young learners could be asked about their own participation and student engagement.

Additionally, the study could be recreated with other primary teacher populations in different regions of the Unites States. A diverse population may result in different instructional decisions and engagement strategies. Ideally, a larger sample size would be preferred to increase the different perspectives of teachers.

Another option for further studies is working with primary teachers in one specific grade level to compare instructional decisions and student engagement strategies.

Finally, a different option may be to have each primary grade level represented and determine how engagement strategies change or remain the same as students age from kindergarten to third grade. This further research could focus on developmentally appropriate student engagement practices.

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APPENDICIES

APPENDIX A

Northern Arizona University IRB approval

NAU NORTHERN ARIZONA UNIVERSITY
Office of Research Compliance

Institutional Review Board for the
Human Research Protection Program

525 S Beaver St
PO Box: 4062
Flagstaff AZ 86011
928-523-9551
https://www.nau.edu/IRB

To:	Tracy Koepke
From:	NAU IRB Office
Approval Date:	February 14, 2022
Project:	Instructional Decisions Primary Teachers Make to Account for Student Engagement in Mathematics
Project Number:	1863275-2
Submission:	Revision
Action:	APPROVED
Project Risk Level:	MINIMAL RISK
New Approval Expiration Date:	February 14, 2027
Review Category/ies:	**The project is not federally funded or supported and has been deemed to be no more than minimal risk.**

This project has been reviewed and approved by an IRB Chair or designee.

- Northern Arizona University maintains a Federalwide Assurance with the Office for Human Research Protections (FWA #00000357).
- All research procedures should be conducted in full accordance with all applicable sections of the guidance.
- The Principal Investigator should notify the IRB immediately of any proposed changes that affect the protocol and report any unanticipated problems involving risks to participants or others. Please refer to Guidance Investigators Responsibility after IRB Approval, Reporting Local Information and Minimal Risk or Exempt Research.
- All documents referenced in this submission have been reviewed and approved. Documents are filed with the HRPP Office within IRBNet. If subjects will be consented, the approved consent(s) are available within IRBNet upon approval notification from the HRPP Office.

Important

The principal investigator for this study is responsible for obtaining all necessary approvals before commencing research. Please be sure that you have satisfied applicable external and University requirements, for example (but not limited to) data repositories, listserv permission, records request, data use agreement, conducting University surveys, data security, international, conflicts of interest, biological safety, radiation safety, HIPAA, FERPA, FDA, sponsor approval, clinicaltrials.gov, tribal consultation, or school approval. IRB approval does not convey approval to commence research in the event that other requirements have not been satisfied.

NAU NORTHERN ARIZONA UNIVERSITY
Office of Research Compliance

Institutional Review Board for the
Human Research Protection Program

525 S Beaver St
PO Box: 4062
Flagstaff AZ 86011
928-523-9551
https://www.nau.edu/IRB

To:	Tracy Koepke
From:	NAU IRB Office
Approval Date:	March 22, 2022
Project:	Instructional Decisions Primary Teachers Make to Account for Student Engagement in Mathematics
Project Number:	1863275-3
Submission:	Amendment/Modification
Action:	APPROVED
Project Risk Level:	MINIMAL RISK
Approval Expiration Date:	February 14, 2027
Review Category/ies:	**The project is not federally funded or supported and has been deemed to be no more than minimal risk.**

This project has been reviewed and approved by an IRB Chair or designee.

- Northern Arizona University maintains a Federalwide Assurance with the Office for Human Research Protections (FWA #00000357).
- All research procedures should be conducted in full accordance with all applicable sections of the guidance.
- The Principal Investigator should notify the IRB immediately of any proposed changes that affect the protocol and report any unanticipated problems involving risks to participants or others. Please refer to Guidance Investigators Responsibility after IRB Approval, Reporting Local Information and Minimal Risk or Exempt Research.
- All documents referenced in this submission have been reviewed and approved. Documents are filed with the HRPP Office within IRBNet. If subjects will be consented, the approved consent(s) are available within IRBNet upon approval notification from the HRPP Office.

Important

The principal investigator for this study is responsible for obtaining all necessary approvals before commencing research. Please be sure that you have satisfied applicable external and University requirements, for example (but not limited to) data repositories, listserv permission, records request, data use agreement, conducting University surveys, data security, international, conflicts of interest, biological safety, radiation safety, HIPAA, FERPA, FDA, sponsor approval, clinicaltrials.gov, tribal consultation, or school approval. IRB approval does not convey approval to commence research in the event that other requirements have not been satisfied.

NAU NORTHERN ARIZONA UNIVERSITY
Office of Research Compliance

Institutional Review Board for the
Human Research Protection Program

525 S Beaver St
PO Box: 4062
Flagstaff AZ 86011
928-523-9551
https://www.nau.edu/IRB

To:	Tracy Koepke
From:	NAU IRB Office
Approval Date:	June 8, 2022
Project:	Instructional Decisions Primary Teachers Make to Account for Student Engagement in Mathematics
Project Number:	1863275-4
Submission:	Amendment/Modification
Action:	APPROVED
Project Risk Level:	MINIMAL RISK
Approval Expiration Date:	February 14, 2027
Review Category/ies:	**The project is not federally funded or supported and has been deemed to be no more than minimal risk.**

This project has been reviewed and approved by an IRB Chair or designee.

- Northern Arizona University maintains a Federalwide Assurance with the Office for Human Research Protections (FWA #00000357).
- All research procedures should be conducted in full accordance with all applicable sections of the guidance.
- The Principal Investigator should notify the IRB immediately of any proposed changes that affect the protocol and report any unanticipated problems involving risks to participants or others. Please refer to Guidance Investigators Responsibility after IRB Approval, Reporting Local Information and Minimal Risk or Exempt Research.
- All documents referenced in this submission have been reviewed and approved. Documents are filed with the HRPP Office within IRBNet. If subjects will be consented, the approved consent(s) are available within IRBNet upon approval notification from the HRPP Office.

Important

The principal investigator for this study is responsible for obtaining all necessary approvals before commencing research. Please be sure that you have satisfied applicable external and University requirements, for example (but not limited to) data repositories, listserv permission, records request, data use agreement, conducting University surveys, data security, international, conflicts of interest, biological safety, radiation safety, HIPAA, FERPA, FDA, sponsor approval, clinicaltrials.gov, tribal consultation, or school approval. IRB approval does not convey approval to commence research in the event that other requirements have not been satisfied.

NAU NORTHERN ARIZONA UNIVERSITY
Office of Research Compliance

Institutional Review Board for the
Human Research Protection Program

525 S Beaver St
PO Box: 4062
Flagstaff AZ 86011
928-523-9551
https://www.nau.edu/IRB

To:	Tracy Koepke
From:	NAU IRB Office
Approval Date:	October 3, 2022
Project:	Instructional Decisions Primary Teachers Make to Account for Student Engagement in Mathematics
Project Number:	1863275-5
Submission:	Amendment/Modification
Action:	APPROVED
Project Risk Level:	MINIMAL RISK
Approval Expiration Date:	February 14, 2027
Next Report Date:	
Review Category/ies:	**The project is not federally funded or supported and has been deemed to be no more than minimal risk.**

This project has been reviewed and approved by an IRB Chair or designee.

- Northern Arizona University maintains a Federalwide Assurance with the Office for Human Research Protections (FWA #00000357).
- All research procedures should be conducted in full accordance with all applicable sections of the guidance.
- The Principal Investigator should notify the IRB immediately of any proposed changes that affect the protocol and report any unanticipated problems involving risks to participants or others. Please refer to Guidance Investigators Responsibility after IRB Approval, Reporting Local Information and Minimal Risk or Exempt Research.
- All documents referenced in this submission have been reviewed and approved. Documents are filed with the HRPP Office within IRBNet. If subjects will be consented, the approved consent(s) are available within IRBNet upon approval notification from the HRPP Office.

Important

The principal investigator for this study is responsible for obtaining all necessary approvals before commencing research. Please be sure that you have satisfied applicable external and University requirements, for example (but not limited to) data repositories, listserv permission, records request, data use agreement, conducting University surveys, data security, international, conflicts of interest, biological safety, radiation safety, HIPAA, FERPA, FDA, sponsor approval, clinicaltrials.gov, tribal consultation, or school approval. IRB approval does not convey approval to commence research in the event that other requirements have not been satisfied.

APPENDIX B

Informed Consent Document

Project Number: 1863275-2
Approval Date: February 14, 2022
This stamp must be on all consenting documents

NAU NORTHERN ARIZONA UNIVERSITY
Office of Research Compliance

Consent to Participate in Research

Study Title: Instructional Decisions Primary Teachers Make to Account for Student Engagement in Mathematics

Principal Investigator: Tracy Koepke

You are being asked to participate in a research study. Your participation in this research study is voluntary and you do not have to participate. This document contains important information about this study and what to expect if you decide to participate. Please consider the information carefully. Feel free to ask questions before making your decision whether or not to participate.

1. **Project Purpose and Description:**

The purpose of this study is to explore and gain a deeper understanding of instructional decisions primary teachers make in order to engage students in math. The researcher will ask primary teachers about their experience of planning for student engagement in math.

The phenomenon of teachers altering, supplementing, and/or utilizing district-given materials to support student engagement will be studied. In simpler terms, the study involves determining the difference between what math resources teachers at a specific school are *given* and what they are *using* to support student engagement. The research is intended to be descriptive in nature in an effort to understand what engagement strategies teachers are implementing in the classroom.

Student engagement research to date has largely focused on middle school and high school. There appears to be little research regarding student engagement at the elementary level, and even less research focusing on primary grades (kindergarten-third grade). Additionally, student engagement research often centers around academic grades and achievement test scores. There are no known studies that focus on instructional decisions primary teachers make to engage students in math.

This research can have practical implications in the classroom. The perspectives and instructional practices of the participants may shed light on engagement strategies other classroom teachers may consider implementing to teach math content in a meaningful and engaging way for their students.

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2. Explanation of Procedures or Protocols:

Participation for this study includes a criteria for teachers:

(a) Participant must be a general education kindergarten, first, second, or third grade teacher.

(b) Participant teaches math.

(c) Participant deemed an exemplary teacher by receiving high ratings on annual teacher evaluation form(s) in the area of student engagement practices.

(d) Participant has some amount of creative control for selecting appropriate teaching resources to best fit the needs of their students in the area of math.

Participating teachers time commitment is approximately 2 hours broken up on different days. Participating teachers will be asked to fill out a brief questionnaire (10-15 minutes) to obtain background information and participate in one interview (approximately 1 hour).

Interviews will take around one hour but are not to exceed an hour and a half. These interviews will be conducted via Zoom and video-recorded with the purpose of transcribing the interview.

During the interview, the researcher will be taking notes about what the interviewee is saying. After the interview, the researcher will transcribe the interview. Participants will be sent a copy of the transcripts to review and verify via OneDrive. At this time, the participant is able to add, modify, or omit any information (approx. 20 minutes time commitment).

3. Confidentiality:

Your name will not be used in any report. The participating school district, schools, principals, teachers and adopted math program(s) will be protected with pseudonyms.

All data collected from individuals will be assigned a code that will only be known to the researcher. The list connecting your name to this code will be kept in a locked filing cabinet. Only the researcher will have access to the file. When the study is completed and the data have been analyzed, the list will be destroyed.

Any identifying information will be blacked out as necessary when submitting paperwork for this study. Information from the questionnaire and interview will be kept confidential. Besides the principal investigator, data without identifying information will be shared with a second coder that is helping with the study.

Paper materials will be stored in a locked filing cabinet during the study. Data collected on paper will be shredded at the end of the study.

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Office of Research Compliance

Video recordings will be kept securely on OneDrive. Video recordings will only be used for the purpose of transcribing. Video recordings will be deleted at the end of the study.

Transcripts will be stored on OneDrive. Forms such as the teacher questionnaire will be stored on a password-protected program (Qualtrics). All data collected electronically will be erased at the end of the study.

The results of this research study may be used in reports, presentations, and publications; however, your personal information will always be anonymous.

The information that you provide in the study will be handled confidentially. However, there may be circumstances where this information must be released or shared as required by law. Northern Arizona University Institutional Review Board may review the research records for monitoring purposes.

4. Benefits:

Teachers have a wealth of knowledge and understanding of student engagement. Participating in this study provides participants with an opportunity to reflect upon their teaching practices and experiences. The insights of teachers can add to the body of research. These voices have the potential to support future engagement practices for other educators.

Additionally, as a 'thank you' for participation, teachers that complete the questionnaire, interview, and verify their transcripts will receive a $10 Starbucks gift card.

5. Risks:

There are no foreseeable risks with this study.

6. Additional Information:

With your permission, I would like to video-record this interview so that I can make an accurate transcript. Recordings will be erased at the end of the study. Your name will not be in the transcript.

For questions, concerns, or complaints about the study you may contact Tracy Koepke.

Name of Faculty Sponsor: Dr. Pamela Powell

NAU NORTHERN ARIZONA UNIVERSITY
Office of Research Compliance

For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact the Human Research Protection Program at 928-523-9551 or online at http://nau.edu/Research/Compliance/Human-Research/Welcome/.

AGREEMENT TO PARTICIPATE

I have read (or someone has read to me) this form, and I am aware that I am being asked to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I affirm that I am at least 18 years of age and voluntarily agree to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

Printed name of subject	**Signature of subject**	**Date**

AGREEMENT TO BE VIDEORECORDED

Subject Signature:_____ Date:_____

APPENDIX C

Recruitment Emails and Letters- School District, Principals, and Teachers

Recruitment Email: School District

Study Title: Instructional Decisions Primary Teachers Make to Account for Student Engagement in Mathematics

Dear _____,

_____ (Name of school district) is being asked to participate in a research study. Your participation in this research study is voluntary and you do not have to participate. The purpose of this study is to explore and gain a deeper understanding of instructional decisions primary teachers (i.e., kindergarten-third grade educators) make in order to engage students in mathematics. The researcher will ask primary teachers about their experience of planning for student engagement in mathematics.

Your role in this study is important and greatly appreciated. I am seeking your consent to approach principals and teachers within the school district to participate in this research.

The benefits of this research may include:

- The research can have practical implications in the classroom. Best practices from exemplary teachers will be highlighted to support student engagement in mathematics.
- The findings have the potential to support future engagement practices for other educators.
- The school district and schools individually may be invested in the outcome as to 'what works' for students, especially when faced with decisions to purchase or provide learning materials for their teachers.

This study has been approved by Northern Arizona University's Institutional Review Board.

For more information, please see the attached letter that explains the study in further detail. The PDF is for you to keep.

Materials that will be used during the study are attached (i.e., recruitment emails to principals and teachers, teacher nomination form, teacher questionnaire, and the interview protocol).

I greatly appreciate your consideration to participate in this study. If you have any questions or comments, please feel free to contact the principal investigator, Tracy Koepke, at (phone number) or (email address).

Kind regards,
Tracy Koepke

Recruitment Letter: School District

(Name of School District) Request for Permission to Conduct Research in Schools

Project Title:

Instructional Decisions Primary Teachers Make to Account for Student Engagement in Mathematics

Dear _____(School District Representative),

_____ (Name of school district) is invited to participate in a research study. The purpose of this study is to explore and gain a deeper understanding of instructional decisions primary teachers make in order to engage students in mathematics. The study involves asking exemplary primary teachers about their experience of planning for student engagement in mathematics.

Purpose:

Further research is needed to address the manner in which primary teachers purposefully account for student engagement during math instruction. After a thorough review of literature, a gap seems to exist regarding instructional decisions teachers are making to utilize or alter district-given materials to support student engagement in the area of primary math. Specifically, it is not known what math resources teachers at a specific school district are *given* and what they are *using*.

Benefits:

The school district can benefit from the research findings in specific ways:

- The research can have practical implications in the classroom. Best practices from exemplary teachers will be highlighted to support student engagement in mathematics.
- The findings have the potential to support future engagement practices for other educators.
- The school district and schools individually may be invested in the outcome as to 'what works' for students, especially when faced with decisions to purchase or provide learning materials for their teachers.

Your role in this study is important and greatly appreciated. I am seeking your consent to approach principals and teachers within the school district to participate in this research.

Brief overview of procedures:

This study will first gain approval from NAU's Institutional Review Board (IRB). Following, school district approval is required. Once permission from the school district has been obtained, elementary school principals will be contacted. The time commitment for principals will be approximately 15 minutes. Principals will be given information about the study and asked to nominate three potentially willing teacher participants. From the list of three teachers, one teacher at random will be contacted. If the first teacher does not wish to participate, a second teacher at random will be selected. If the second teacher contacted also does not wish to participate, the third teacher will be contacted. Ideally, 5-8 participants will be involved in the study, one teacher per elementary school.

The time commitment for teachers is approximately 2 hours broken up on different days. Teachers will be asked to fill out a brief questionnaire to obtain background information. Teachers that meet the criteria for participation (please see below for criteria) will be invited to participate in a one-session interview (approximately one hour, not to exceed an hour and a half) to discuss student engagement as it pertains to math instruction and learning materials.

The criteria for participation includes requirements for both the selected school district and the participants.

<u>The school district criteria involves:</u>
(a) a public school district
(b) The school district has to have adopted a math textbook program.

<u>The participant requirements include:</u>
(a) The participant must be a general education kindergarten, first, second, or third grade teacher.
(b) Teacher instructs math.
(c) Participant deemed an exemplary teacher by receiving high ratings on annual teacher evaluation form in the area of student engagement practices.
(d) Teachers have some amount of creative control for selecting appropriate teaching resources to best fit the needs of their students.

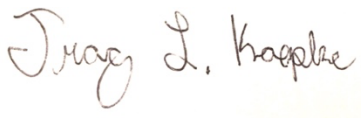
Confidentiality practices will be in place to ensure anonymity for the school districts, schools, teachers, and adopted math programs throughout the study.

Please see the informed consent form for more detailed information regarding the purpose of the study, procedures, and confidentiality information. Additionally, other forms are available to you upon request including the letter to principals and the questionnaire for participants.

The primary investigator is Tracy Koepke, a doctoral student at Northern Arizona University (NAU). This study is in partial fulfillment for the requirements of a Ph.D. in Curriculum and Instruction.

Thank you for your consideration to participate in this research study. I look forward to hearing back from you. Additionally, if you have any questions, please feel free to contact the principal investigator, Tracy Koepke, at (email address) or (phone number).

Kind regards,



Tracy Koepke

Recruitment Email: Principals

Study Title: Instructional Decisions Primary Teachers Make to Account for Student Engagement in Mathematics

Dear Principal _____,

You are being asked to participate in a research study. Your participation in this research study is voluntary and you do not have to participate. The purpose of this study is to explore and gain a deeper understanding of instructional decisions primary teachers (i.e., kindergarten-third grade educators) make in order to engage students in mathematics. The researcher will ask primary teachers about their experience of planning for student engagement in mathematics.

Your role in this study is important and greatly appreciated. Your time commitment in this study is approximately 15 minutes.

The benefits of this research may include:

- The research can have practical implications in the classroom. Best practices from exemplary teachers will be highlighted to support student engagement in mathematics.
- The findings have the potential to support future engagement practices for other educators.
- The school district and schools individually may be invested in the outcome as to 'what works' for students, especially when faced with decisions to purchase or provide learning materials for their teachers.

This study has been approved by Northern Arizona University's Institutional Review Board and _____ (name of school district).

For more information, please see the attached document that includes a letter to principals with an attached teacher nomination form. The PDFs are for you to keep.

Please nominate three primary teachers at your school for participation by using the link below:

(Qualtrics link to digitally complete form)

I greatly appreciate your consideration to participate in this study. If you have any questions or comments, please feel free to contact the principal investigator, Tracy Koepke, at (phone number) or (email address).

Kind regards,
Tracy Koepke

Recruitment Letter: Principals

Project Title:

Instructional Decisions Primary Teachers Make to Account for Student Engagement in Mathematics

Dear Principal,

You are invited to participate in a research study. I thank you in advance for your consideration to contribute to this research study.

The purpose of this study is to explore and gain a deeper understanding of instructional decisions primary teachers make in order to engage students in mathematics. The researcher will ask exemplary primary teachers about their experience of planning for student engagement in mathematics.

Further research is needed to address the manner in which primary teachers purposefully account for student engagement during math instruction. After a thorough review of literature, a gap seems to exist regarding instructional decisions teachers are making to utilize or alter district-given materials to support student engagement in the area of primary math. Specifically, it is not known what math resources teachers at a specific school district are *given* and what they are *using*.

It is hoped this research can benefit school districts, schools, and teachers. The findings may have practical implications in the classroom. The perspectives and instructional practices of the participants may shed light on engagement strategies classroom teachers may consider implementing to teach math content in a meaningful and engaging way for their students. Additionally, schools or school districts may be invested in the outcome as to what works for students, especially when faced with decisions to purchase or provide learning materials for their teachers.

Your role in this study is important and greatly appreciated. I kindly ask you to provide contact information for three potentially willing participants. Below are the criteria for participating teachers.

Please select three candidates that meet all of the following criteria:

1. Primary teacher (kindergarten, first, second, or third grade teacher)
2. General education teacher
3. Teacher instructs math during a typical school day.
4. Teacher is deemed an ‘exemplary’ teacher by receiving high ratings on annual teacher evaluation form(s) in the area of student engagement practices.

5. Teachers at the selected school have some flexibility to choose appropriate math learning materials.

Name of School: _____

Principal:

First name: _____

Last name: _____

Teacher Nominations:

Teacher A:

Name: _____

E-mail: _____

Phone number: _____

Teacher B:

Name: _____

E-mail: _____

Phone number: _____

Teacher C:

Name: _____

E-mail: _____

Phone number: _____

One teacher from the provided list will be contacted at random. If he/she is not wanting to participate, a second teacher will be contacted. If the second teacher contacted chooses not to participate, the third teacher will be contacted.

Thank you for your time and participation.

The principal investigator is Tracy Koepke, a doctoral student at Northern Arizona University (NAU). This study is in partial fulfillment for the requirements of a Ph.D. in Curriculum and Instruction.

If you have any questions, please feel free to contact Tracy Koepke at (email address) or (phone number).

Recruitment Email: Teachers

Study Title: Instructional Decisions Primary Teachers Make to Account for Student Engagement in Mathematics

Dear _____,

You are being asked to participate in a research study. Your participation in this research study is voluntary and you do not have to participate. The purpose of this study is to explore and gain a deeper understanding of instructional decisions primary teachers (i.e., kindergarten-third grade educators) make in order to engage students in mathematics. The researcher will ask primary teachers about their experience of planning for student engagement in math.

Your role in this study is important and greatly appreciated. Your time commitment in this study is approximately 2 hours broken up on different days.

The benefits of this research may include:

- The research can have practical implications in the classroom. Best practices from exemplary teachers will be highlighted to support student engagement in math.
- The findings have the potential to support future engagement practices for other educators.
- The school district and schools individually may be invested in the outcome as to 'what works' for students, especially when faced with decisions to purchase or provide learning materials for their teachers.

This study has been approved by Northern Arizona University's Institutional Review Board and _____ (name of school district).

For more information, two documents are included: (1) an informed consent form and (2) a questionnaire (approximately 10-15 minutes to complete). The PDFs are for you to keep.

If you wish to participate, please digitally sign at the bottom of the consent form using the link below:

(Qualtrics link to informed consent form)

Additionally, please digitally fill out the questionnaire by using the link below:

(Qualtrics link to teacher nomination form)

I greatly appreciate your consideration to participate in this study. If you have any questions or comments, please feel free to contact the principal investigator, Tracy Koepke, at (phone number) or (email address).

Kind regards,

APPENDIX D

Questionnaire- Primary Teachers

Questionnaire: Primary Teachers

Project Title:

Instructional Decisions Teachers Make to Account for Student Engagement in Mathematics in the Primary Grades

Dear Participant,

You are invited to participate in a research study. I thank you in advance for your consideration to participate in this study.

The purpose of this study will be to explore and gain an in-depth understanding of primary teachers' experiences relating to student engagement instructional decisions in math. The phenomenon of teachers altering, supplementing, or utilizing district-given materials to support student engagement and understanding will be studied. In simpler terms, the study involves determining the difference between what resources teachers at a specific school are *given* and what they are *using* to support math student engagement.

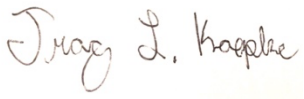
I kindly ask you to complete this questionnaire regarding math student engagement practices. The goal of this questionnaire is to collect necessary background information relating to the study.

Please read and sign the informed consent form on Qualtrics. This letter will explain the study in greater detail.

Your involvement in this study is very important to me. Pseudonyms will be used to identify participants throughout the study, therefore ensuring your identity will remain anonymous. Data will be stored securely using the password-protected program Qualtrics on a password-protected computer. Interview recordings and notes will only be used for the purpose of transcribing. Interview recordings, questionnaires, notes, and written correspondence will be deleted following the completion of the study, in accordance with Northern Arizona University's data management policy.

Again, I thank you for your participation. I will contact you after receiving your questionnaire response in regard to your future participation in this study.

Sincerely,



Tracy Koepke

The principal investigator is Tracy Koepke, a doctoral student at Northern Arizona University (NAU). This study is in partial fulfillment for the requirements of a Ph.D. in Curriculum and Instruction.

If you have any questions, please feel free to contact Tracy Koepke at (email address) or (phone number).

(Adapted questionnaire letter from Powell, 2005)

Questionnaire

Please answer the following questions. If, however, you feel uncomfortable about any of these questions, move on to the next one.

First name:		**Last name:**	
Present Age:		**Gender:**	
Preferred pronouns:		**Ethnicity:**	
Race:		**Country of birth:**	

1. Are you a certified teacher in Arizona?

2. What is the highest degree or level of school you have completed?

3. During the 2021-2022 (or 2022-2023) school year, what grade(s) do you teach?

4. Are you a general education teacher?

    a. If not, what is your current position?

5. How many years (including this year), have you taught?

6. What grades have you taught?

7. How long have you taught each grade level?

8. During this school year, do you teach mathematics?

9. If yes, how often do you teach mathematics during a regular school week?

10. On average, how many minutes long are each of your math lessons?

11. What math program/textbook has your school district purchased?

12. What math resources has your individual school purchased?

13. What math resources do you use?

14. Describe your amount of creative control in selecting math materials.

15. Describe student engagement strategies you utilize to teach math.

16. On your teacher evaluation this year, did you receive an above average rating in the area of student engagement practices?

Student demographics:

Please answer the following questions regarding your class of students for the 2021-2022 (or 2022-2023) school year.

1.) How many students are in your class?

2.) How many students of each gender?

Boys:	
Girls:	
Gender not specified:	

3.) How many students in your class identify as…

White or Caucasian:	
Black or African American:	
Hispanic or Latino:	
Asian or Pacific Islander:	
Native American or Alaskan Native:	
Multiracial or Biracial:	
Race/ethnicity not listed here:	

4.) According to daily performance, test scores, and grades, how many of your students in class are considered...

Above level in math:	
On-level in math:	
Below-level in math:	

1. **Interview:**
   Following the completion of this questionnaire you will be contacted regarding your participation in a one-session interview. Interviews will be approximately one hour but are not to exceed an hour and a half.

   a. **Are you willing to be interviewed via Zoom video conferencing? Please select one response.**

o Yes, I am willing to be interviewed via Zoom.

o No, I am not willing to be interviewed via Zoom.

   b. **Interviews will be video-recorded for transcribing purposes to ensure data are properly collected. Please select one response.**

o I agree to have the interview video-recorded.

o I do not agree to have the interview video-recorded.

Thank you for your participation in this questionnaire.

APPENDIX E

Interview Protocol

Interview Protocol

Project Title: Instructional Decisions Teachers make to Account for Student Engagement in Mathematics in the Primary Grades

Thank you for your willingness to participate in this interview. The purpose of this interview will be to explore and gain an in-depth understanding of your experiences relating to student engagement instructional decisions in primary math.

May I have your permission to record this interview? (Depending on the answer) I will be video-taping this interview on Zoom for transcription purposes as well as taking notes about your experiences. I am very interested in hearing all you have to say. The notes and recording will help me to better capture your experience.

Your involvement in this study is very important to me. All written correspondence, questionnaires, interview responses, etc. will be destroyed at the end of the study. In addition, pseudonyms will be used to identify participants throughout the study, therefore ensuring you remain anonymous.

I would like to ask you a few questions regarding your instructional decisions to support math student engagement. If, at any time you feel uncomfortable about a question, just let me know and we will move on to the next question. The interview can be stopped at any time.

(Adapted interview protocol introduction from Powell, 2005)

1. Thank you for submitting your questionnaire via Qualtrics. This provided me with a great deal of information. I will be asking you to explain some of your answers. Are you ready to begin? (Check to make sure recording is working.)

Probes or follow-ups will be used as needed throughout the interview including but not limited to:

- Can you tell me more about that?
- Can you give me an example?
- What do you mean?

- Would you explain that?

2. Can you walk me through a typical day in your classroom during your math block? (RQ1)
    - How is your math block setup? (What happens first, next, etc.?)
    - How many days a week do you teach math?
    - How many minutes are dedicated to math instruction each day/week?
    - Do you teach whole group or small group?
    - Do students work independently?
    - What does independent work look like?
    - Do students work with a partner?
    - What do partner activities look like?
    - Do students work in a small group?
    - What are small groups working on?
    - If in a small group, how are students grouped?

3. How do you know when students are engaged in math? (RQ1a)
    - How do you know when students are disengaged in math?
    - What does it look like?
    - What does it sound like?
    - What are students doing?
    - What are you, as the teacher, doing?

4. What is your definition of student engagement? (RQ1a)

5. What role does student engagement play in your classroom? (RQ1)
    - What influences you to integrate student engagement practices in math?

6. What instructional decisions do you make to engage students in math? (RQ1)
    - What are some of your favorite strategies?

7. How do you decide which engagement strategies to use in your math instruction? (RQ1)
    - Where did you learn engagement strategies?
    - Where do you continue to get ideas?
    - What negative experiences, if any, have you had when attempting to integrate engaging strategies?

8. How do you differentiate your math engagement strategies? (RQ1)
    - How do you engage your struggling learners?
    - How do you engage your excelling/ above-level learners?

- How do you engage your on-level learners?
- How do you engage students with accommodations (i.e., Individualized Education Plan (IEP), 504 plan, and/or English language learners (ELL)?

9. What materials do you use to teach math? (RQ2)
    - Where did you locate these materials?
    - Do you use online materials?
    - If so, which ones?
    - What materials do you use the most frequently?

10. You indicated on the questionnaire your school district provided you the math program _____ (math materials) to teach math. How do you use this program? (RQ2)
    - What aspects of the program do you like?
    - What aspects of the program do you not like?
    - How do these materials support student engagement?

11. In your questionnaire, you mentioned you have _____ creative control in selecting math materials. Can you please expand? (RQ2)
    - How do you decide which materials to use?
    - What instructional materials are you required to use to teach math?
    - What role does student engagement play in selecting materials?

12. What changes to district-provided instructional materials do you make to enhance student engagement in math? (RQ2)
    - How do you alter materials?
    - Why do you make these changes?
    - What materials do you replace?

13. You indicated on the questionnaire your individual school purchased _____ (math materials) to teach math. Can you explain how you use this/these program(s)? (RQ2)
    - What do you like about these materials?
    - What do you dislike about these materials?
    - What changes do you make to these materials?
    - What supplemental math materials do you use to replace school provided materials?
    - What other math resources has your school purchased?
    - How do these materials support student engagement?
    - How do you alter or change these materials?
    - How do students respond to these materials?

14. In your experience, what math materials promote student engagement? (RQ1a)
    - How often do you use these materials?
    - What district-given materials promote math student engagement?

- What instructional material has your school given you that promotes student engagement?
- What math materials are your students' favorite?

15. Is there anything else you would like to tell me about math student engagement in your classroom?

16. Thank you for your time and participation. I will be sending you a transcript of our interview within the next two weeks for you to review. At that time, I would like for you to read it and add, edit, or delete any information you might deem necessary. Please email me back with any changes or approval once you have had the opportunity to review it.

17. Lastly, do you know any other primary teachers in your school district that may be interested in participating in this study? (i.e., A general education teacher that is highly effective in student engagement strategies)

    - What is their name?
    - What is the name of their school?
    - What is their email address?
    - What is their phone number?