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Differentiated Instruction: Understanding the personal factors and organizational conditions that facilitate differentiated instruction in elementary mathematics classrooms

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Differentiated Instruction: Understanding the personal factors and organizational conditions that facilitate differentiated instruction in elementary mathematics classrooms

By

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Professor Sheldon Zedeck

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ABSTRACT

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Doctor of Education

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Differentiated instruction is a widely held practice used by teachers to provide diverse learners with complex learning opportunities in the area of mathematics. Research on differentiated instruction shows a multitude of factors that support high quality instruction in mixed-ability elementary classrooms. These factors include small-class size, extra time and resources that allow for a highly individualized approach to instruction, teacher commitment, and subject-matter competency in mathematics. The literature also points to the role of leadership in providing a greater investment in teachers' professional development to improve teacher practice. This in-depth case study is an attempt to understand what resources and supports are needed to build teachers' capacity to effectively implement differentiated instruction to meet the challenges of teaching diverse learners found in classrooms today.

For this study, I developed a conceptual framework to map the territory for understanding what personal factors and organizational conditions facilitate high quality implementation of differentiated instruction. Drawing from the literature, I identified specific personal factors and organizational conditions to study. I incorporated these criteria when I observed and interviewed the nine participants selected for this study. During the course of the study, I investigated across two different school environments, a high wealth and a low wealth district, and the dimensions that shaped the practices identified as high quality implementation of differentiated instruction. Overall, this framework allowed me to examine the differences in teacher practice that are not currently found in the literature.

The findings of the study indicate several personal dimensions that distinguish a high implementer from a low and average implementer of differentiated instruction in mathematics. The dimensions are: a willingness to forge ahead and overcome obstacles; willingness to grow professionally and improve practice; strong competency, capability, and confidence teaching the subject matter; and ability to implement complex instruction in a variety of situations. All these coupled with prior teaching at the same grade level and strong classroom management skills increased the level of implementation quality. But even the high implementers made it clear that organizational conditions specifically, the pressure of daily work demands, put severe constraints on their ability to differentiate instruction in their classrooms. No amount of skill and determination or ample organizational resources could overcome these constraints.

DEDICATION

This dissertation is dedicated to my husband, Edward, whose unconditional love has supported me throughout this incredible journey. You sacrificed so much, and without you, I would not be who I am today.

And to my mother, Lena, and sister, Toni, who have always believed in me, and what I might one day accomplish.

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CHAPTER I: INTRODUCTION

Statement of the Problem

Many researchers and educators advocate for curricular and instructional reform to address the unique skills and abilities of students in mixed-ability classrooms (Darling-Hammond et al., 2005; Elmore, 1996; Goddard, et al., 2007). Researchers (Gamoran & Weinstein, 1995; Tieso, 2003; Houtveen & Van de Grift, 2001) have praised the practice of differentiated instruction as a means of increasing student participation and interaction through a set of matching tasks, activities and resources, and providing instruction that is tailored to support individual students' needs. Within this context, researchers have studied the positive effects of homogenous and heterogeneous grouping within class environments (Gamoran & Weinstein 1995), thus favoring detracking (Oakes, 1985; Oakes, Gamoran & Page, 1992) to improve mathematics instruction (Esposito, 1973; Slavin, Madden & Leavey, 1984; Slavin, 1985, 1987 1990; Lou et al, 1996; Gamoran & Hannigan, 2000) for students by adjusting the range of ability and differentiating instruction within the classroom.

Yet, even though differentiated instruction within class environments is supported in theory by both researchers and educators, in reality, differentiated instruction as a practice is difficult to implement in the classroom, because most often, instruction is not tailored for students' readiness, interest, and learning profiles (Tomlinson, 2003). In particular, many educators indicate that unequal access to differentiated curricula produces further inequities in student learning of mathematics (Gamoran & Hannigan, 2000). In order to prepare elementary students for future academic opportunities in mathematics in a competitive, global society, teachers need to implement instructional strategies that cater to a wide variety of learning profiles. Studies (Tomlinson, 2006; Wood, 2007) that investigate the impact of the leaders on teacher learning assert the need for districts to build teacher capacity and provide resources and professional development for curriculum differentiation. Wood (2007) points to the role of district leadership in providing a greater investment in teachers including time, support, and an immediate sense of efficacy to improve teacher practice. According to Wood (2007), when teachers and coaches were given the structure and district support to engage in collaborative activities, there was a significant increase in participation and collaboration. Subsequently, Tomlinson (2006) posits that one of the factors that influences a child's ability to learn is the difference in support systems afforded to a student who is characterized by ability, race, culture, gender, and life experiences.

Since school policies often limit students' opportunities for students to enter into advanced math courses as they enter middle school (Oakes, 1985; Oakes, Gamoran & Page, 1992), it is vital for elementary educators to understand the instructional strategies that will improve students' acquisition of mathematics skills. With the pressures of high stakes testing, it is no longer acceptable to teach in a "drill and kill" manner and perform rote calculations. Elementary teachers need a deep understanding of mathematics in order to teach students the conceptual skills needed for later years. Additionally, in an era of inclusive educational environments as described in No Child Left Behind (NCLB, 2001), where the goal is to provide each child with equal access to a high quality education program, educators are mandated by accountability measures to increase student performance with limited resources. Only by examining teachers in practice will I understand what resources and supports are needed to build

teachers' capacity to effectively vary lessons to meet the diverse needs of all learners within their classroom environments for mathematics.

Problem at the State Level

It is a known fact that in order for students today to compete in a global society, California students are required to graduate from high school with competency in mathematics. District leaders cannot ignore the importance of understanding what is being done in the elementary years since students in 10th grade are expected to show competency in the following areas: computation, arithmetic, statistics, data analysis, probability, number sense, measurement, geometry, mathematical reasoning and algebra. The California High School Exit Exam (CAHSEE) is the state legislature's response to improving pupil achievement in high school mathematics and was implemented as a condition of high school graduation. By the time students reach high school, students often do not possess the necessary skills in mathematics and are tracked by ability, preventing them from realizing their full potential (Gamoran & Hannigan, 2000). The College Board's 'Equity 2000' program encouraged the introduction of more complex concepts such as algebra during elementary years to ensure proper preparation for high school (Gamoran & Hannigan, 2000). Often elementary teachers rarely have the strong mathematical background to prepare students to understand the complex language of mathematics as they progress toward middle and high school. In turn, studies of mathematics teaching and learning show that this lack of knowledge affects elementary teachers' capacity to provide high quality differentiated instruction in mathematics **(**Ball, 1990; Ball & Bass, 2000; Tomlinson & McTighe, 2006).

As California public school districts implement site improvement and intervention plans to increase academic performance in math, teachers are faced with a laundry list of state standards. Teachers are so stretched to address each standard that they find little time to present lessons in any depth, even though research suggests that teachers who have high expectations with clear, consistent, and coherent curriculum have the greatest impact on student achievement (Marzano, 2003). While these problems cannot be answered without looking deeper into elementary classrooms and teacher practice, research (Gamoran & Weinstein, 1995) suggests that implementing differentiated instruction as part of the school environment is shaped by the organization's norms and values such as culture, commitment, routines, beliefs, and philosophy.

Problem at the District Level

My own interest in this realm of inquiry has been fueled by my past experiences as an elementary and middle school mathematics teacher, as well as by my current experiences as the Superintendent of the West County School District (WCSD)[1]. As a teacher, not only have I witnessed the benefits of a differentiated approach to teaching mathematics, but I have also experienced the challenges of implementing differentiated instructional strategies in my daily teaching of mathematics. Over the last six years, the mathematics proficiency level of the WCSD middle school students has decreased. I hypothesize that student performance in mathematics has decreased because teachers lack the skills required to tailor instruction to address students' needs, and they lack the resources, materials, and training to implement differentiated instruction in mathematics. The question that guided my study is: what are the organizational conditions that

[1] School district, names, and titles have been changed to ensure anonymity and confidentiality.

may be readily influenced by the instructional leader within a school to assist teachers in incorporating differentiated instructional strategies in elementary mathematics classrooms?

As superintendent and researcher, I am interested in how the new knowledge garnered by this study might serve to improve the teaching and learning of mathematics within a school and similar environments. Hence, from my unique vantage point as both an instructional leader and researcher, I have undertaken this study as a viable project towards addressing these inquiries to inform future theory and practice in the field of elementary mathematics education.

Purpose of the Study

In response to the problem at both the local and state levels, the purpose of this qualitative case study is to shed light on what instructional leaders can do to facilitate positive changes in the area of mathematics for students with a wide variety of learning styles. The proposed study tries to understand (1) what personal factors make elementary teachers high implementers of differentiated instructional practices in mathematics, and (2) what key organizational conditions may be malleable by instructional leaders to facilitate such practices for elementary teachers. My reasons for pursuing this study are two-fold. First, I hold the educational value that curriculum should be differentiated to meet the diverse needs of students within a mixed-ability classroom. Research on differentiated instructional practices has noted improved academic achievement in mathematics (Esposito, 1973; Slavin, Madden & Leavey, 1984; Slavin, 1985, 1987 1990; Lou et al, 1996; Gamoran & Hannigan, 2000). Second, I am committed as a superintendent and instructional leader to exploring what personal factors make teachers embrace the practice of differentiated instruction for mathematics together with understanding what organizational conditions within the school are malleable by the instructional leader to support teachers in meeting the needs of diverse learners.

During my inquiry, Piaget's theory of cognitive development has informed my knowledge and understanding of the cognitive development of mathematics for elementary age students (Piaget, 1970). My understanding of Piaget's theory has reinforced the need for teachers to vary instruction to meet the needs of diverse learners in a typical elementary mathematics classroom. In this study, I will be able to examine teachers over time and distill what personal factors differentiate high implementers from low implementers of differentiated instruction. The main emphasis of this in-depth case study focuses on gathering data from elementary mathematics teachers who practice differentiated instruction and understand specific ways in which teachers can be supported through organizational conditions in meeting the needs of diverse learners within their classroom environments.

Significance of the Study

Researchers (Fielder, Lange & Winebrenner, 2002) assert that "equality in education does not require that all students have exactly the same experiences; rather, education in a democracy promises that everyone will have an equal opportunity to actualize their potential, to learn as much as they can" (p. 109). Differentiated instruction is one way to provide diverse learners with equal opportunities. The rationale for this study is grounded in a review of the literature outlined in Chapter Two, specifically the research on differentiated learning, teacher learning, and theories on organizations. A review of the literature provides empirical data to support effective instruction in the context of differentiation and shows a multitude of factors

that support high-quality instruction in mixed-ability classrooms including small class size allowing for more differentiation, extra time and resources that allow for highly individualized approach to instruction, commitment to equity across classes, and teacher's intellectual commitment to the subject matter (Gamoran & Weinstein, 1995). Understanding teachers' personal beliefs about their skills, interest in equity, and perceptions about the organization will allow me to examine the phenomenon of differentiated instruction as it emerges during the study.

Problems of Practice

The theory of action supported by researchers and practitioners behind implementing differentiated instruction is that differentiation is an effective way of meeting the diverse academic needs of students in elementary classrooms (Tomlinson, 1999, 2000, 2001; Tomlinson & McTighe, 2006). A substantial body of literature is available on strategies for implementing differentiated instructional strategies in the classroom such as differentiating for content, process, and product (Tomlinson, 1999, 2000, 2001; Tomlinson & McTighe, 2006). At the same time, research on grouping students flexibly within the same classroom environment for mathematics is one way to support students in their learning (Slavin, 1990). However, even experienced teachers who believe in the importance of differentiation and recognize the need to reach all learners continue to teach in more traditional ways, using strategies, materials, and resources familiar to them (Cuban, 1984). Studying teachers over time will allow me to understand the relationship between the theory and practice of differentiated instruction from a practitioner's perspective.

This in-depth, qualitative case study is grounded in social and organizational theories. These theories, which are found in a review of the literature in Chapter Two, are appropriate for studying the perceptions and experiences of the participants over time, and their relationship to the organizational conditions outlined in this study (Creswell, 2009). The main purpose of the research is, first, to understand the multiplicity of personal beliefs, attitudes, skills, organizational constraints, and enabling conditions that facilitate the implementation of differentiated instruction, and second, to distill those factors malleable by the instructional leader to facilitate change in elementary classrooms.

Research on teachers' personal beliefs, attitudes, and skills about differentiated learning strategies in elementary mathematics classrooms informs the central questions of this study. A review of the literature informs my knowledge of classifying what personal factors make a teacher a high or low implementer of differentiated instruction, and what organizational conditions may support teachers in facilitating such practices for students in mixed-ability mathematics classrooms. With the literature specifically focused on differentiated instruction, I presume that implementation is focused when teachers (1) are motivated to forge ahead to meet the diverse needs of students, (2) committed to equity and are student-centered, and (3) possess a high degree of skills to implement differentiation (Tomlinson, 2001; Tomlinson & McTighe, 2006). In addition, I draw from theories on organizations to provide a set of organizational conditions such as (1) influencing norms and values, (2) available resources and materials, and (3) quality professional development as conditions that may support teachers in implementing differentiated instructional practices in elementary classroom environments (Oakes, Gamoran, & Page, 1992; Gamoran & Weinstein, 1995).

CHAPTER II. REVIEW OF THE LITERATURE

Introduction

Walking into an elementary classroom today, one will see a mosaic of students with varying backgrounds and abilities. Students have individualized needs making it more and more difficult for teachers and administrators to deliver a wide variety of instructional strategies in an equitable and efficient manner. This challenge becomes even more difficult when a laundry list of state standards has been added to teaching elementary mathematics in a mixed-ability classroom. For teachers who lack the skills, support, and strategies to academically challenge students with diverse learning needs, district leaders need to provide support and leadership for their teachers. While studies show that socioeconomic factors influence a student's ability to succeed (Oakes, 1985; Oakes, Gamoran & Page, 1992), the National Council of Teachers in Mathematics (NCTM, 2007) posits that instructional methods implemented in the classroom do have an effect on student learning. Researchers (Esposito, 1973; Slavin, Madden & Leavey, 1984; Slavin, 1985, 1987 1990; Lou et al, 1996; Gamoran & Hannigan, 2000) support adjusting the range of academic skills and differentiating instruction within the classroom to improve mathematics instruction for students. Tomlinson (2001) asserts that when successfully implemented, differentiated instruction is a method that allows teachers in mixed-ability classrooms to deliver instruction that is challenging for each student. Researchers and practitioners have documented theories based on empirical data that are the foundation of using differentiated instruction as a strategy for improving instruction. Exploring these theories through a review of the literature supports the conceptual framework of this study that examines what organizational conditions the instructional leader within the school can potentially influence. Towards this end, the review of literature examined includes these areas: differentiated instruction, theories on learning, mathematical understanding and instruction, ethics and equity, overarching theories of teacher learning, and theories of organizational conditions.

Extensive research of the literature was conducted for the review. Professional peer-reviewed journals, books, and on-line dissertations, as well as published works on differentiated instruction were examined. JSTOR, SAGE, ERIC, and EBSCO databases provided through the University of California, Berkeley library and other Internet searches were used. Keywords and phrases searched were: curriculum differentiation, differentiated instruction, math instruction, differentiation, learning theory, constructivist theory, heterogeneous classrooms, mixed-ability classrooms, professional development, teacher learning, ethical leadership, organizational structures, and diversity. The purpose of this literature review was to understand and validate the claims of this study and provide other educators with empirical data about the personal factors and organizational conditions that facilitate differentiated instruction in mathematics teaching and learning.

The Phenomenon of Differentiated Instruction

Differentiated instruction has been described in a multitude of ways, but all definitions share a common core focus that differentiated instruction attempts to provide equal access to high quality instruction for diverse learners. While differentiation is often defined as responsive teaching, differentiated instruction is not necessarily a set of instructional practices that can be easily identified. Instead, as discussed earlier in this paper, the practice of differentiated

instruction is rooted in the works of constructivist theorists such as Dewey (1938), Piaget (1970), Vgotsky (1978), Feuerstein (1980) and Gardner (1983; 1991; 1993). For this case study, research from both theorists and practitioners is used to create the operationalized definition used in this study to define the phenomenon of differentiated instruction. I borrow Stradley and Saunders' definition of differentiated instruction, which involves the method of matching tasks, activities, resources, and learning support to individual learners' needs, styles, and rates of learning (Stradley & Saunders, 1993). Similarly borrowed is practitioner Carol Tomlinson's definition, responsive teaching practices wherein teachers do whatever it takes to support a wide range of learners (Tomlinson, 2001). Tomlinson's definition is a set of beliefs compiled from research about teaching and learning in which:

- Students learn best when curriculum and instruction are delivered in a manner that builds upon students' strengths and asks teachers to stretch students' thinking beyond their comfort zone (Gardner 1983, 1991, 1993; Vgotsky, 1978).

- Students are engaged in meaningful, valued, and purposeful instruction (Kapusknick & Hauselein, 2001) where supportive teachers celebrate and respect student diversity and provide high quality instruction.

- Teachers respect differences and develop a diverse knowledge base, using varied culturally responsive materials and assessments and building culturally caring environments so that instruction is paced accordingly for all students (Gay, 2002; Montgomery, 2001).

- Teachers' goals for students must be based not only on students' individual interests but also on broader social purposes in elementary and secondary education and therefore teachers need to (1) construct curriculum that connects to students' lives and experiences; (2) allow for students to participate in the classroom and within the diverse community; (3) support academic, civic and personal goals for students; and (4) support equal access to curriculum (Darling-Hammond, et al 2005).

Why differentiate instruction?

According to the work of Claude Steele (1998), students who are challenged by their teachers and held to high standards are more likely to succeed than students who are stereotyped before they enter school (Jencks & Philips, 1998). The reality is that the efficacy of the learning environment is a function of many complex factors. Despite the complexities, Shapiro (2003) emphasized the moral imperative for teachers to change their ways and engage students by allowing them to have a more active role in their schooling. Perkins (1999) believed that teachers who embrace pragmatic constructivism practices and differentiate instruction as part of their repertoire contribute to creating learning opportunities for further learning and collective capacity (Little, 2007) for students and teachers. Noble (2004) points out that there are two reform movements that call for differentiated instruction. The *inclusive schooling movement* advocated for the inclusion of special education students in mainstreamed classrooms (Foreman, 2001; Stainback & Stainback, 1996) and the *gifted education movement* called for more challenging instruction in the mixed ability classroom (Clark, 1997; Cohen, 1992; Tomlinson,

1999). Each movement takes into consideration students' abilities in today's mainstream classroom environments.

Research on differentiation and opportunities for restructured schools shows that tracking students is not an equitable or moral solution for educating diverse student populations (Gamoran & Weinstein, 1995), especially in the area of mathematics. Kapusnick and Hauselein's work, 'The Silver Cup of Differentiated Instruction,' (2001) closely characterizes today's differentiated classroom as one where teachers celebrate and respect student diversity, and use a variety of resources and techniques to engage students in meaningful, valued, and purposeful instruction. For mathematics instruction, the *National Council of Teachers in Mathematics Standards 2000* (NCTM, 2000) project united reform efforts in the United States by establishing equity and standards-based curriculum in the area of mathematics. These standards marked a historically important first step in creating challenging goals for students in the area of mathematics, and described a future in which all students have equal access to high-quality mathematics instruction taught by knowledgeable teachers who receive adequate support and ongoing professional development (NCTM, 2000).

Characteristics of differentiated instruction

In this study, differentiated instruction is an instructional strategy to address the unique learning styles and intelligences in the classroom. Researchers (Oakes, Gamoran, & Page, 1992; Stradling & Saunders, 1993) identify curriculum differentiation instructional strategies in two different contexts: organizational and pedagogical. As explained by these researchers, differentiated instruction in the organizational context is (1) creating small class groupings allowing for more differentiation, (2) providing extra resources and materials that allow for highly individualized approach to instruction, and (3) normative traditions such as a beliefs, values and commitment to equity across classes (Oakes, Gamoran, & Page, 1992; Gamoran & Weinstein, 1995). These researchers categorize pedagogical context as the curriculum and instructional strategies that occur at the school level such as matching learning targets, tasks, activities, resources and learning support to individual learners' needs, styles and rates of learning (Stradling & Saunders, 1993). Teachers who differentiate instruction do so because they are aware of the developmental learning differences among students and support self-regulated learning, monitor student outcomes, and adapt the curriculum (Houtveen and Van de Grift, 2001).

Drawing from the literature (Oakes, Gamoran, & Page, 1992; Gamoran & Weinstein, 1995; Stradling & Saunders, 1993; Houtveen and Van de Grift, 2001), I identified three behaviors characteristic of teachers who differentiate instruction. They are (1) varying delivery of instruction within the classroom environment, (2) using multiple resources and materials, and (3) flexibly grouping students within the classroom environment. Accordingly, these characteristics have been distilled as the teachers' behaviors to be observed and outlined in the conceptual framework for this study, and will be used to classify the level of curriculum differentiation during the data analysis phase of this case study. Operationalized definitions for these three behaviors to be observed follow.

Varied delivery of instruction within the environment

Several strategies for varying the delivery of instruction within a mixed-ability classroom include responding to learners' needs by category of readiness, interest, learning profile or a combination of three of these categories (Tomlinson & McTighe, 2006). Differentiated instructional strategies that have been found to be effective when responding to a learner's need by readiness include: scaffolding, tiering, or compacting instruction. The concepts of scaffolding, tiering and compacting an assignment are closely related to the work of Vgotsky's Zone of Proximal Development ('ZPD') in which assignments are divided into small tasks that are constructed upon one another and focused on student readiness. Gardner's work on multiple intelligences addresses differentiated instructional strategies that best support students' interests and learning profiles and include: interest centers, independent studies, intelligence preference tasks, and varying modes of teacher presentation to address multiple intelligences (Gardner 1983, 1991, 1993; Tomlinson & McTighe, 2006).

Use of multiple resources and materials

In the context of curriculum differentiation behaviors, a myriad of resources and materials need to be used by the teacher to address the unique needs of students by interest, readiness, and learning profile. Educational practitioners Tomlinson and McTighe (2006) offer several examples for using multiple resources and materials in the classroom. They are: (1) a collection of books with different readability levels and interests to support access for all students at their appropriate challenge level, (2) using both visual and auditory technology for students who struggle with print or have other learning preferences that would best be supported with additional resources, and (3) providing resources such as vocabulary lists in other languages to support English language learners. Each example provides opportunities for students to be more involved in their learning, and for the teacher to support the differentiated needs of the students. Constructivist theories (Dewey, 1938; Feuerstein, 1980; Gardner 1983, 1991, 1993; Piaget, 1970; Vgotsky, 1978) posit that the use of multiple resources and materials provides access for each type of learner, challenging students to make meaning of their experiences and construct their own knowledge.

Flexibly grouping students

Schools are charged with decisions on how to group students for mathematics (Slavin, 1987, 1990) and through their impact on curriculum and instruction, these decisions have important consequences on students, especially low-performing students who are tracked throughout their education (Oakes, Gamoran & Page 1992). Research has shown that teachers may group students in a number of configurations. The practice of grouping students by ability within classroom environments in mathematics has shown to increase student achievement in inclusive settings for both high performing and low performing students (Tieso, 2003; Houtveen & Van de Grift, 2001). Literature on the positive effects of homogenous and heterogeneous grouping (Gamoran & Weinstein 1995) to improve mathematics instruction (Esposito, 1973; Slavin, Madden & Leavey, 1984; Slavin, 1985, 1987 1990; Lou et al, 1996; Gamoran & Hannigan, 2000) suggests adjusting the range of ability within classroom groupings to garner the highest benefits for students.

In addition to grouping students by ability, teachers can flexibly group students by time, space, and learning strategies (Tomlinson & McTighe, 2006). Examples of flexible use by time include: (1) negotiating due dates for assignments, compacting or exempting students from daily work, and (2) using homework to support or enrich students' learning. Options for differentiating by space, teaching and learning strategies include: (1) creating zones for independent, small group, or whole class instruction, (2) posting several room arrangements so students can quickly rearrange the room depending on the task, (3) encouraging students to work alone, with a peer, or in a small group, and (4) using pre-assigned groups by interest, reading and learning profile (Tomlinson & McTighe, 2006).

The Challenges of Implementing Differentiated Instruction in Elementary Mathematics

A review of the literature on mathematics teaching and learning informs and helps deepen the understanding of why it is so difficult to differentiate instruction in mathematics. According to researchers (Ball, 1990; Ball & Bass, 2000) and based on the works of John Dewey (1938) on teacher preparation, tension continues to exist between the 'proper relationship' between subject matter knowledge and the development of pedagogy (p. 85). On one hand, Dewey would argue that what matters most in teaching is caring for students and having the necessary skills to work with diverse learners. On the other, researchers (Ball, 1988; Ball, 1990; Ball & Bass, 2000) would argue that subject matter knowledge and development of pedagogy is equally important because mathematical knowledge is often taken for granted and what is needed in practice is often misunderstood by teachers. This kind of understanding is especially true in the teaching of elementary mathematics because it requires a deep and complex understanding of several intertwined conceptions of content and pedagogy that most often are built up by teachers over time and is what constitutes mathematical proficiency (Ball & Bass 2000). A broad research base on teaching and learning of elementary mathematics conducted by National Research Council (2004) indentifies these intertwining conceptions as (1) conceptual understanding, which is the comprehension of mathematical concepts, operations and relations, (2) procedural fluency, which is the skill in carrying out procedures flexibly, accurately, efficiently and appropriately, (3) strategic competence, which is the ability to formulate, represent and solve mathematical problems, (4) adaptive reasoning, which is the capacity for logical thought, reflection and justification, and (5) productive disposition, which is the habitual inclination to see mathematics as sensible, useful and worthwhile, coupled with a belief in diligence and one's own efficacy (p. 218). Unfortunately, understanding subject matter knowledge of mathematics does not provide an adequate understanding of what mathematics knowledge is and how it is used in practice (Ball & Bass, 2000). In order to understand the intricacies of this study and why differentiated instruction is difficult to implement in elementary mathematics, a host of factors need to be explored. They are: (1) understanding the personal factors that make it hard for teachers to teach mathematics in complex ways such as personal philosophy about children, subject matter competence, the development of mathematics instruction, and degree of skills, (2) overarching theories on learning in order to understand how both typical and atypical children learn in order to classify what makes a teacher a high or low implementer of differentiated instruction, and (3) understanding what organizational conditions may or may not be present for implementation to occur such as normative traditions, time, materials, resources, and professional development opportunities.

Personal factors as it relates to the overarching theories on teacher learning

Teachers' classroom responsibilities at times seem endless. Responsibilities include knowledge of subject matter content and pedagogy in mathematics, knowledge and use of materials, planning skills, classroom management skills, and knowledge of child growth and development. While there is a considerable body of literature investigating pedagogical content knowledge and the teacher's specific understanding of the subject matter, an underlying guiding proposition for this study and the conceptual framework is concerned with understanding what personal factors facilitate instructional change. Studies from the literature provide an understanding of the dynamic interplay of teacher's content knowledge of mathematics and pedagogy with real-time problem solving that occurs in practice (Ball & Bass, 2000). For example, Villegas and Lucas (2002) posit that teachers' disposition need to include seeing themselves as both responsible and capable of bringing about educational change. Theories on teacher learning attribute several personal factors to change of practice. They are: (1) teacher's beliefs and knowledge about the subject matter, (2) teacher's pedagogical repertoire, (3) teacher's willingness to forge ahead, and (4) teacher's expectations for students (Stodolsky & Grossman, 2000). A review of the literature on theories of teacher learning as it relates to personal factors follows.

Teacher's beliefs and knowledge about elementary mathematics instruction

Empirical literature on mathematical understanding and teacher education informs my understanding of teachers' ideas, feelings, and knowledge about mathematics. In one longitudinal study of 217 elementary education teachers and 37 mathematics teachers, Ball (1990) found that a teacher's feelings about mathematics were interrelated with their substantive understanding of mathematics and how the teacher feels about himself as a teacher and mathematician. Ball posits that a teacher's approach to solving problems is shaped by self-confidence, the repertoire of strategies employed, background knowledge related to the concept (e.g. division) being taught, and willingness to solve the problem in the first place (p. 461). Additionally, common preconceptions about mathematics in the United States include: '*mathematics is about learning to compute, mathematics is about following the rules to guarantee correct answers, and some people have the ability to do math and some don't*' (NRC, 2004, p. 220). Unfortunately for some students who attend school in the United States and with the rise of standards based reform, teachers are pressured to increase mathematical scores through high stakes performance assessments, thus, creating by some accounts, environments where students are learning little more than test questions (Gamoran et al, 2003) and teachers lack the knowledge and belief to teach mathematics for understanding (Ball, 1990). On one hand, in a teacher-focused mathematics classroom, often the teacher organizes the curriculum and presents the information in a traditional manner set-up to support direct instruction. Student desks are arranged in rows and teachers fall back on familiar routines, and preconceptions about mathematics and practices to manage students (Cuban, 1984). On the other hand and for the purposes of this study, in empirical studies on student-centered classrooms and mathematics, high quality and equitable mathematics instruction may often be organized by ability grouping within the classroom creating opportunities for learning mathematics both conceptually and strategically (Gamoran et al, 2003). According to researchers (Gamoran et al, 2003; Ball, 1990), transforming teacher beliefs in mathematics depends on how schools and districts support on-

going change and provide the necessary time, resources, and professional development to support differentiated instruction. In a study on teachers in Japan (Gamoran et al, 2003), teacher collaboration was the result of some level of social, material, and human resources contributing to overall commitment to student-focused teaching of mathematics.

A closer examination of the literature on mathematics education provides the professional expectations and challenges for educators in teaching this content area. As stated earlier with the problems at both state and local levels as well as the problems of practice, subject matter traditions in mathematics are more oriented towards whole class instruction and teachers continue to teach in more traditional ways, using strategies, materials, and resources familiar to them (Cuban, 1984). In order to implement differentiated instructional practices in mathematics, educators need to understand what it is they need to know about teaching the highest quality of mathematics in an equitable manner for all students (Ball, 1990; Ball & Bass, 2000; NCTM, 2000). According to the research conducted by National Council of Teachers of Mathematics (2000), educators are guided by six-core principles characteristic of high quality mathematics instruction: equity, curriculum, teaching, learning, assessment, and technology. For purposes of this study, equity, curriculum, teaching, and learning are the most relevant principles for understanding what instructional leaders can do to facilitate differentiated instruction in the area of mathematics and have informed the researcher's conceptual framework, design and methodology. These four principles are summarized below. Assessment and technology are not included in this review and case study.

The equity principle

The equity principle as described by NCTM in mathematics education requires that all educators strive to provide high quality instruction and support for all students. This principle asserts that excellence in mathematics is the result of teachers who have high expectations and provide differentiated support to meet the needs of diverse learners in an equitable, challenging, and supportive environment. For students who struggle with mathematical concepts, teachers are expected to provide the high expectations similar to those of regular or gifted students and support students to reach their highest potential. Additionally, from the empirical literature on teacher learning of mathematics (Ball & Bass, 2000), knowing content knowledge is a critical component in creating dynamic classroom experiences that take into account a student's interest, experiences, and understanding.

The curriculum principle

The curriculum principle puts emphasis on mathematics being more than a collection of activities but instead includes high quality curriculum that is coherent and focused across the grade (NCTM, 2002). In *How Students Learn Mathematics* (National Research Council, 2004), the authors argue that students' understanding of the curriculum needs to be deeper than just successfully learning to compute and complete worksheets. Student understanding of mathematics is a by-product of teachers' total preconceptions and dispositions toward mathematics (Ball, 1990; Ball & Bass, 2000). Thus, in order to engage students in the study of mathematics, teachers need a thorough and clear understanding of a multitude of concepts underlying an area of mathematics in order to teach math proficiency. NCTM *Standards 2000* project recommended on-going professional development as a remedy to this problem. The

research on what we are learning about mathematics instruction, clearly shows that teacher preparation and on-going training is needed to help move teachers to implement the kinds of mathematical curriculum needed to teach mathematics (Ball, 1990).

The teaching principle

The teaching principle asks the question: what mathematical knowledge and pedagogy are needed to teach elementary students a deep understanding of the conceptions of math (Ball & Bass, 2000). Assuming teachers possess the conceptual understanding of mathematics, the teaching principle asserts that effective mathematics instruction requires varied instructional approaches in order to support and challenge students (NCTM, 2002). Teachers must be able to identify what a student knows and then develop and implement strategies that best support each child. NCTM's teaching principle aligns with the need for differentiated instruction as an instructional strategy used in the conceptual framework for this case study, and identifies not just what teachers must know to teach mathematics but how teachers use that knowledge to make the subject matter meaningful.

The learning principle

Grounded in empirical research on how students learn mathematics (Ball, 1990; Ball & Bass, 2000; NCTM, 2002; NRC, 2004), the learning principle asserts that students learn mathematics by building upon prior knowledge while actively constructing new knowledge. This literature helps formulate the explanatory factors of the conceptual framework for this study. Like the equity principle, the learning principle aligns closely with the theories on differentiated instruction by asserting that learning in the classroom must be student-centered, and focused on the individual needs of each learner. Understanding how the learning principle relates to practice informs me about the mathematical resources needed for teaching diverse learners, the role of the resources in the learning process, and the opportunities needed to be developed for teachers to teach mathematics well (Ball & Bass, 2000).

Teacher's pedagogical repertoire

Based on the multiples perspectives of teaching and learning with an emphasis on mathematics (Dewey, 1938; NRC, 2004; Ball, 1990; Ball & Bass, 2000), researchers suggest that teachers need to have more than content knowledge in order to be successful. Teachers need to understand their own learning styles and struggles in order to recognize strategies that will increase their pedagogical repertoire. Perkins (1999) describes four characteristics teachers must possess in order for learning to occur: (1) teachers creating knowledge about teaching and learning, (2) teachers communicating knowledge to one another, (3) teachers organizing knowledge within themselves in order to make it more meaningful to others, and (4) teachers acting on new knowledge in order to improve student learning. Taking into account a mathematical perspective on the work of teacher pedagogy requires teachers to know not only the content but also how to solve mathematical problems that arise in the course of teaching elementary students (Ball & Bass, 2000). According to Ma (1999), a deep understanding of mathematics requires a fundamental understanding of mathematics in terms of depth, breadth, and thoroughness. Ma asserts that teachers must be able to challenge students, problem solve,

and navigate the course with a knowledge similar to that of an 'experienced taxi driver's knowledge of the city, whereby one can get to significant places in a wide variety of ways, flexibly, and adaptively' (p. 123).

Research on differentiated instruction and mathematics instruction both assume that a basic attitude focused on a structure of discipline and the importance of teachers' classroom management skills is needed to teach to a wide range of learning styles in a mixed-ability mathematics classroom (Ma, 1999; Ball & Bass, 2000; Tomlinson, 2001). Even the most experienced teachers often do not possess the necessary classroom management skills to effectively maintain a differentiated classroom without the necessary time, materials, and resources (Cuban, 1984). In reality, teachers often fall back to traditional teaching methods, and reliance on textbooks to evaluate the needs of diverse learners (Cuban, 1984). Teachers will need to possess more than a basic knowledge of mathematics. Teachers will need to be consistent in their practices, challenging students in mathematics based on their ability and interest in order to teach mathematical understanding. Even the most dedicated, reflective teachers will be unable to implement differentiated instruction in mathematics without the support of the professional organization and strong leadership. Organizational leaders need to prioritize building norms and values supporting collaboration and teacher professional development towards an instructional vision focused on high quality mathematics instruction (Gamoran et al, 2003).

Teacher's willingness to forge ahead within the organization

According to Schön (1983) teachers by nature are reflective practitioners and may often acknowledge what is needed in the classroom. Reflection as it relates to a teacher's willingness to forge ahead is based on teachers' experiences and intuition to problem solve (Schön, 1983; Ball & Bass, 2000). Unfortunately, more often teachers are overwhelmed by the challenges of teaching in structurally complex and politically charged environments with many competing demands, hindering any professional growth and reflection (Schön, 1983). Given the pressures of new initiatives both at the local and state levels, teachers often resist change and conform to the existing resources available to them (Gamoran et al, 2003). In contrast, teachers who are confident about their skills are more likely to adapt their curriculum, collaborate with colleagues, and make the necessary changes within their practices needed for student success (Stodolsky & Grossman 2000). In order for teachers to be more reflective and confident to forge ahead, several essential conditions need to exist within the organization for widespread change of teacher practice (Gamoran et al, 2003; Talbert & McLaughlin, 1994). The are: (1) providing tools and resources that support student learning, (2) understanding and ability to respond to students' needs, (3) understanding the big ideas in mathematics and the ability to relate them to students' ideas, (4) understanding the differences among students with a focus on qualitative aspects that students bring to the classroom and not just the quantitative differences in ability and motivation, and (5) having the ability to develop social norms in classroom learning communities that promote engagement and learning for all students (p. 16). Research on how teachers might develop usable mathematical understanding (Ball & Bass, 2000) deepens my knowledge of how to create opportunities for learning mathematics as well as provides me with an understanding of what teachers need to know and learn in order to teach students with varied learning styles in mathematics (p. 99). Reflection is a powerful resource for solving problems when teachers receive the support needed in understanding the complex and diverse learning environments they are faced with every day (Schön, 1983). As a practitioner and researcher, Tomlinson (1999)

offers a strategy whereby teachers use 'reflection-in-action' to envision how a differentiated lesson will begin, progress, and end when given the appropriate time, resources, and support.

Teacher's expectations for students

The literature on what elementary teachers bring to the teaching of mathematics helps me understand that teachers' expectations for students in mathematics is often focused on three strands: teacher's knowledge of mathematics, ideas about mathematics teaching and learning, and feelings about oneself in relation to mathematics (Ball, 1988, p. 42). Research (Darling Hammond, et al 2005) also suggests that teachers' beliefs about learners often influence what and how they teach, and that a teacher's goals for students must be based not only on their own individual interests but also on broader social purposes in both elementary and secondary education. Darling Hammond et al (2005) claim that teachers need to construct curriculum that: (1) connects to students' lives and experiences, (2) allows for students to participate in the diverse classroom community, (3) supports goals for students that are academic, civic, and personal in nature, and (4) supports equal access to curriculum. In harmony with the research on differentiated instruction, Tomlinson (2003) adds that teachers must also consider what occurs within the learning environment and how a student's self-esteem and emotional stability can affect their learning. Students will continue to learn depending upon the teacher's perception of a student's ability, and how the teacher responds to the student's needs (Tomlinson, 2003).

Personal behaviors and their connection to theories on learning

In order to assess the level of implementation quality of differentiated instruction for each participant in the study, theories on learning need to be fully understood. A review of the literature on theories of learning suggests that facilitating differentiated instructional practices in classrooms is complex. The work of constructivist theorists John Dewey, Jean Piaget, Lev Vgotsky, Reuven Feuerstein, and Howard Gardner provide a fundamental understanding of how students learn best, and espouse implementing practices and examining behaviors whereby teachers create learning experiences that challenge students to make meaning of their experiences and construct their own knowledge (Dewey, 1938; Feuerstein, 1980; Gardner 1983, 1991, 1993; Piaget, 1970; Vgotsky, 1978). Connecting mathematical concepts to constructivist theories on learning suggests that students need a more active role in critical thinking and problem solving activities to stimulate their interest and knowledge in mathematics (Senge, 2000). While researchers on theories of learning offer no specific curriculum that can be easily implemented by teachers to differentiate instruction practices for mathematics, mathematics reform movements today base recommendations on constructivist theories (Schön, 1987). Only in the last ten years have researchers (Tomlinson & McTighe, 2006) been able to piece together the theories of learning to what is needed to implement differentiated instruction in the classroom. For this study, the researcher has distilled from the literature three teaching behaviors linked to the theories on learning and research on differentiated instruction as to what would makes a teacher a high implementer of complex instruction. These behaviors are found in teachers who: (1) vary delivery of instruction, (2) use multiple resources and materials, and (3) group students flexibly to provide challenging experiences for all students (Tomlinson & McTighe, 2006). These behaviors are outlined in the conceptual framework as behaviors to be observed.

Overarching theories of organizations

Researchers (Gamoran & Weinstein, 1995; Gamoran et al, 2003, Talbert & McLaughlin, 1994) suggest that a school's organization is shaped by its norms and values such as culture, commitment, routines, beliefs, and philosophy. Earlier research of school organizations focused on two models: the nested-layers model and the loose-coupling model (Gamoran et al, 2003) as paradigms for school improvement. The nested-layer model portrays schools systems that are arranged in complex layers where the way to change is to manage the flow of resources available to teachers. In this model, teachers are autonomous and at the same time are constrained by the amount of resources available. The loose-coupling model renders school organizations as a set of parameters such as facilities and professional activities that are disconnected. For example, organizational leaders in this model often lack agreement regarding the purpose and goal of the school, often not focused on teaching and learning. Both models are limited in understanding what organizational conditions are needed today to address the inequities in school and the pressures of accountability.

Three key organizational conditions as gleaned from the literature describe a new dynamic model drawing upon both the nested-layers and loose coupling models and other theoretical approaches (Gamoran et al, 2003) to support high-quality instruction within the organization. These three conditions are: (1) influencing norms and values based on a commitment to equity (2) available resources and materials that allow for highly individualized approach to instruction (Hall, 2002; Loveless, 1998), and (3) quality professional development available to teachers (Gamoran & Weinstein, 1995). These three conditions are used as the explanatory factors of the conceptual framework for this study.

Influencing norms and values based on a commitment to equity

Equitable outcomes for elementary and secondary students vary significantly depending upon the school's norms and values and its response to the effectiveness of the learning community on improving achievement. In Noble's case study, "Integrating the Revised Bloom's Taxonomy with Multiple Intelligences: A Planning Tool for Curriculum Differentiation," she examined 16 teachers in grades K-6 in two elementary schools who used the multiple intelligence theory and revised Bloom's taxonomy (RBT) to differentiate instruction. Her findings supported the work of Guskey (1986) and confirmed substantial change in teachers' attitudes and beliefs when teachers changed their practices and began to see the positive results on students' outcomes of their changes. Arthur Shapiro asserts that a supportive culture begins with establishing a clear mission and purpose, a system of communication to articulate the purpose, and a system of cooperation to achieve the mission and purpose (Shapiro, 2003). The literature suggests that influencing norms and values must support building a community as a vital factor in facilitating change within the organization.

A review of the literature (Friend & Pope, 2005; Louis & Kruse, 1995; Rosenholtz, 1991; Westheimer, 1998) on developing professional learning communities suggests that collaboration is a key ingredient to improving instructional practices (Friend & Pope, 2005; Gay, 2002; Louis & Kruse, 1995; Westheimer, 1998). Teachers who are confident about their skills are more likely to adapt their curriculum, collaborate with colleagues, and make the necessary changes within their practices essential for student success (Stodolsky & Grossman 2000). Stodolsky and Grossman (2000) assert that creating a community for teacher learning depends highly upon the

environment that exists for learning. Studies (Tomlinson & Kalbfleisch, 1998; Tomlinson, 2003; Villa & Thousand, 2003) show that several elements need to be considered in order to form such a community to implement complex instructional methodologies into teacher practice such as differentiated instruction. These elements include:

- Educational members of the learning community including teachers, administrators, and support staff who view diversified learning as positive, realistic, collaborative and doable;

- Educational team that believes philosophically that students come from a variety of educational, socioeconomic and cultural backgrounds and all have unique learning styles;

- Roles and relationships among the adults and students needs to be redefined to foster an environment of cooperation and trust between students, staff and administration; and

- Access and utilization of all available resources according to Norland (2003), making a fluid school in which students are able to utilize the entire school as their classroom and teachers promote learning as determined by students' needs.

Teachers need to be actively engaged with other colleagues in a collaborative community and attend professional development to improve student learning. Little (2002) confirmed when teachers collectively address ineffective routines they examine new ways of responding to challenges and engage in new methods of teaching. Teacher learning becomes apparent. Little's findings assert that the professional community is a contributing factor to teacher development, collective capacity, and improvements in teaching and learning.

Leadership and collegial interactions such as the existence of a professional learning community (Grossman et al, 2001) are conditions that may contribute to teacher development and collective capacity in improvements in teaching and learning, especially when teachers share the same professional standards as the leader of the organization (Talbert & McLaughlin, 1994). Goddard and her colleagues (2007) studied both the formal and informal configurations in which collaboration exists. The authors found that special education teachers, as well as middle school teachers, work more collaboratively because of organizational opportunities such as time, materials, and resources that exist at a school.

While it is clear that the teacher community is a means for school improvement, Grossman and her colleagues (2001) outlined the features needed to create and sustain a learning community in the workplace and argued that in order to implement a teacher professional community, the focus must be equally concerned with teacher learning as well as student learning. One of the factors contributing to the success or failure of teacher instructional practices, as Little (2002) points out, is the teachers' workplace relationships and the professional community organized by the teachers. When a professional relationship is formed at a school, researchers (Louis & Kruse, 1995) indicate that a collective responsibility for student success occurs. The works of Louis and Kruse (1995) suggest schools that function as professional communities improve teacher practice by allowing for collective responsibility and sense of purpose, which in turn builds trust. Bryk and Schneider (2002) concluded that

workplace relationships give us good reason to believe that fostering trust and collaboration in schools has a profound effect on school reform.

Available resources and materials

The availability of resources including time, materials, and learning opportunities provided to teachers by the organization increase the likelihood that teachers match tasks and activities to support individual learners' needs (Gamoran & Weinstein, 1995). O'Day and her colleagues (1995) suggest building capacity by adding resources such as teachers, technology, materials, and by restructuring how work is organized, and by restructuring how services are delivered to student and teachers. In a study of 24 highly restructured schools, Gamoran and Weinstein (1995) also found conditions that support high quality instruction in mixed ability classrooms which include small class size, extra resources and materials, strong intellectual leadership, and high quality teachers who have the intellectual commitment to subject matter and to equity across classes. In the context of teaching elementary mathematics for understanding, research on transforming teaching in mathematics and science provides similar conditions such as resources, materials, and professional development as ways to support teaching for mathematical understanding (Gamoran et al, 2003). From the perspective of 60% of teachers who were interviewed, time was considered the most valuable resource needed for planning and learning with other teachers (Gamoran et al, 2003).

Teachers supported through quality professional development

Students in a typical elementary mathematics classroom possess a wide range of academic abilities, knowledge, and interest as they come from diverse backgrounds and cultures (Tomlinson & McTighe, 2006). While differentiated instruction is considered an ideal practice to meet these challenges often elementary teachers rarely have the strong mathematical content knowledge and pedagogy needed to prepare students to understand the complex and abstract language of mathematics as students progress toward middle school (Gamoran & Hannigan, 2000). Even the most experienced teachers recognize the need to tailor instruction to meet the unique needs of students, but unfortunately even teachers with the best intentions resort to traditional ways of teaching, such as whole class instruction, often leaving students behind. Teachers tend to teach what is most comfortable to them and fall back on well-developed routines and practices (Cuban, 1984). Additionally, teachers are reluctant to implement complex instructional strategies that they are not familiar with and cannot do so with ease and confidence (Tomlinson & McTighe, 2006). According to Resnick and Hall (1998), teachers will need a thorough understanding of subject matter content (e.g. differentiated instructional practices) to facilitate equitable learning experiences. One of the challenges for instructional leaders will be to plan professional development activities that lead to the facilitation of differentiation in elementary mathematics classrooms.

Talbert and McLaughlin (1994) claim teachers are potentially an important source of establishing work norms around planning any professional development. A study (Grossman, et al, 2001) of English and social study teachers found that teachers negotiate their practices based on their perceptions of the organization. In this study, a vision of teacher community is located in the workplace, offering the possibility of individual transformation as well as the transformation of the social settings in which individuals work through a professional development project.

Teachers met twice monthly to create an interdisciplinary curriculum for English and social studies. With a shared sense of responsibility, teachers designed a professional development model and discussed ideas about pedagogy.

Conceptual Framework

Thus two literatures help me to conceptualize my study. The research on teacher learning helps to deepen my understanding of the salient behaviors, personal factors, and organizational conditions that may facilitate differentiated instructional practices. Grounded in social and cognitive theories, I posit that differentiation is an effective way of meeting the diverse academic needs of students in elementary mathematics classrooms (Slavin, 1990; Tomlinson, 1999, 2000, 2001; Tomlinson & McTighe, 2006). The research asserts that teachers are more likely to implement differentiated instruction when organizational conditions that support teacher learning are present (Gamoran et al, 2003). I am interested in what instructional leaders can do to facilitate the practice of differentiated instruction in mathematics by understanding what organizational conditions are most effective for teachers who are considered high implementers of this practice.

In order to deepen my understanding of the problem, I have distilled from the professional knowledge base a number of personal factors related to teacher learning of mathematics, and organizational conditions related to the practice of differentiated instruction. I hypothesize that high implementers of differentiated instruction for teaching mathematics (1) are motivated to forge ahead to meet the diverse needs of students, (2) are committed to equity and are student-centered, and (3) possess a high degree of skills to implement differentiation (Tomlinson, 2001; Tomlinson & McTighe, 2006). Consequently, I assume teachers' beliefs, attitudes, skills, and perceptions of the organization may be strikingly different for teachers who are classified as low implementers. These behaviors, personally or organizationally motivated, serve as key elements of the conceptual framework for this study and are depicted in Figure 1.

The conceptual framework for this study serves to orient my in-depth study. It maps the territory of potential factors to study but the researcher operation in the naturalistic setting of a case cannot be certain upfront which of these factors might be most salient, how these factors interact with each other, or what other factors, not previously theorized may turn up as salient. This in-depth study will allow me to interpret the differences among cases with respect to factors outlined in my conceptual framework as well as those factors that emerge from the data and not included in my framework.

The research questions for this study are concerned with understanding the personal factors and organizational conditions that facilitate differentiated instruction in elementary mathematics classrooms and how teachers respond to and reorient themselves to different classroom environments with students with diverse needs. I draw from theories of learning to provide a set of behaviors to be observed for classifying how high implementers of differentiated instruction reconcile and respond to the challenges of teaching in mixed-ability classrooms. The problems of practice for elementary teachers of mathematics begin when teachers' personal beliefs about students and skills stand in conflict with the very incentives intended to motivate them such as the availability of resources, materials, and quality professional development. I hypothesize that while some teachers (i.e. high implementers) embrace the norms and values of the organization, others may want to continue to do what they have always done and what is most comfortable. I hope that as a result of this study, I will be able to understand what

conditions are needed to support low implementers to change their practice. For example, if low implementers are highly motivated to forge ahead and value differentiated instruction as a meaningful practice, these teachers may become energized to forge ahead given the necessary resources, materials, and professional development. On the other hand, if low implementers are given all the same resources and materials as high implementers, I can assume that perhaps factors more personal in nature and far less malleable to the influence of organizational leadership may play a larger role.

In sum, this in-depth, qualitative case study is grounded in social and organizational theories. I am concerned with understanding the relationship between teachers' personal beliefs about students, the subject matter, and their experiences over time within the organization in order to distill what organizational conditions malleable by the instructional leader facilitate differentiated instruction in elementary mathematics classrooms.

Figure 1: Conceptual Framework

Differentiated Instruction: Understanding the personal factors and organizational conditions that facilitate differentiated instruction in elementary mathematics classrooms.

Figure 1.1

Problem

The demand for differentiating instruction in mathematics is pervasive and teachers clamor for it because most classrooms consist of students with heterogeneous skills, yet implementation has proved to be challenging.

Purpose

To identify key organizational conditions that are malleable by instructional leaders that facilitate curriculum differentiation practices within elementary school environments.

Figure 1.2 – Research Design

Cases	Data Sources
DI_1	S1=Observations
DI_2	S2=Interviews
DI_3	S3=Document collection
DI_4	(to include student work)

Figure 1.3: Data Analysis

The Phenomena of Curriculum Differentiation

Explanatory Factors

Organizational Conditions
C1= Norms & values
C2= Available resources & materials
C3= Quality of professional development

Personal Factors
F1= Highly motivated to forge ahead
F2= Student-centered & committed to equity
F3= High degrees of skills

Behaviors to be observed and explained
B1=Varied delivery of Instruction
B2=Uses multiple resources and materials
B3=Groups students flexibly

High Implementers
DI_1+ YES
DI_2+ YES

Low Implementers
DI_3- NO
DI_4- NO

CHAPTER III. RESEARCH DESIGN AND METHODOLGOY

Introduction

In this chapter, I explain the details of the research design and methodology of this qualitative case study. I begin with an outline of the research questions and design, the description of the research sites, the sample, and the instruments used in the study. The final sections of this chapter focus on the data collection strategies, data analysis processes, and a discussion on issues of validity, transferability, bias, rigor, and issues and handling strategies.

Research Questions

1. What instructional behaviors distinguish high implementers and low implementers of differentiated instructional practices?

2. What are the personal challenges teachers encounter when implementing differentiated instruction in classrooms?

3. What organizational conditions do teachers perceive as providing them with the most support to differentiate instruction?

4. What are the malleable organizational conditions within a given school that need to be supported by the instructional leader in order to assist teachers in incorporating differentiated instructional strategies in elementary mathematics classrooms?

Research Design

This research employed an inquiry-based, qualitative, multi-case study design concerned with understanding the phenomenon of differentiated instruction by identifying multiple personal factors and organizational conditions that shape teachers' thinking and acting. Given that I perceive data collection as a "collective enterprise" between the researcher and her informants with the ultimate purpose of understanding how to transform teaching and learning practices of elementary mathematics teachers, a narrative, qualitative, and descriptive (Creswell, 2009) case study approach (Yin, 2009) is appropriate. The fundamental purpose of this case study is oriented towards what Miles and Huberman (1994) refer to as "explicating the ways people in a particular organization come to understand, account for, take action, and otherwise manage their day-to-day situations" (p.7). This study, thus examines the "everyday ways" in which teachers carry out their practice and allowed the researcher to compare, sort, and analyze those findings (Mills, 2007). Thus, this research design captures what Miles and Huberman (1994) define as the basis of qualitative research, namely, "well-grounded, rich descriptions and explanations of processes in identifiable local contexts" (p. 1). But it does so with pre-formulated theoretical constructs that guided my inquiry.

I chose a multiple case study design because I wanted to learn the differences between high and low quality implementers across two distinct organizational contexts. Collecting data from multiple and contrasting cases adds rigor to the findings of this study (Miles & Huberman, 1994; Yin, 2009). According to Yin (2009), a finding extrapolated from a multiple case design is

considered to be more compelling and powerful than that of a single case study design. As a reflective observer and practitioner (Schön, 1983) and acting upon what Dewey (1938) refers to as the act of making meaning of experiences, I interpreted the meanings teachers constructed. A qualitative research design enabled me to interpret meanings and make sense of situations through teacher interviews and classroom observations. Within the constructs of implementing these research strategies, interview and observation protocols were used to gather, collect, record, and interpret information about the phenomenon and context of this study.

Throughout the study, I gathered data through classroom observations and participant interviews. The data helped me understand how teachers perceived students learn mathematics best, how they saw their role as teachers, how they dealt with constraints of what they perceived to be good practice, and what organizational conditions support best practices for differentiated instruction.

Research Methodology

In order to strengthen the validity of the findings in this case study, I studied nine cases (Miles & Huberman, 1994). Through interviews and observations, I analyzed the data collected from teachers, sorted the data into categories outlined in the conceptual framework of this study, and searched for additional explanations. This qualitative research design lent itself well to what Yin (2009) refers to as a logical plan of designing, preparing, collecting, describing, analyzing, interpreting, and sharing observations. My goal was to conduct an analysis of the multiple cases by first looking at each individual case separately.

Research sites

As an educator for the past twelve years, I had the advantage of having a wide network of schools to use for my sample. I invited teachers from two different suburban elementary schools, the North Court School and South Court School[2] who had the reputation of implementing differentiated instruction as a strategy to meet the needs of students. A review of each school's mission and value statements depicts similarities that encompass a vision for providing a strong academic program through innovative teaching methods using technology and research-based best practices, as well as acknowledging and addressing the individual learning styles of each student through differentiated instruction.[3] As I began my inquiry, I was also interested whether differences in student population had any impact on level of implementation quality of differentiated instruction. A comparison of student enrollment by various characteristics is represented in Figure 2, demonstrating the differences in student population and diversity at the two sites. The chart shows, for instance, that North Court School had a higher percentage of students with learning disabilities at 17% of student population as compared to 8% at South Court School[4] while South Court's student population was more culturally diverse with a higher percentage of English language learners.

[2] All program and people's names have been changed to ensure anonymity and confidentiality.

[3] Source: North Court School and South Court School Accountability Report Cards (2009). Retrieved July 23, 2011. (pseudonym).

[4] Ibid.

Figure 2: Characteristics of student enrollment at each school site

Group	Enrollment North Court School	Enrollment South Court School
Number of students	360	280
Black/African American	1%	1%
Asian	0	34%
Filipino	2%	7%
Hispanic or Latino	1%	16%
Pacific Islander	3%	5%
White (not Hispanic)	92%	35%
Socioeconomically disadvantaged	N/A	19%
English Learners	1%	29%
Students with disabilities	17%	8%

Five of the participants selected work at North Court School located in a small, affluent community in California serving approximately 360 students in grades K-8. According to the Academic Performance Index (API) score, which is California's measurement of the academic growth of schools, North Court School received a score of 939, considered exceptional in the State as compared to an API score of 798 for the average K–8 school.[5] From my review of the district's mission statement and vision, the philosophy of the North Court has not changed over the years. As documented in its recent strategic plan, the school prided itself on working with teachers to cultivate learning, to provide high quality teaching for all students, and to expand differentiated instruction training and research based on best practices.[6] Teachers at North Court were also fortunate to be housed in one building. This organizational structure allowed teachers to have common planning time to communicate with each other and follow students' progress by walking into the next classroom or visiting a teacher down the hall. Students benefited from additional support from a full-time counselor, art teacher, two music teachers, physical education teacher, and two Spanish teachers. In addition, leadership provided opportunities for teachers to access outside professionals, a mathematics coach, and professional development training during the school year.

Four of the participants selected work at South Court School located in a middle-class bedroom community serving approximately 280 students in grades K-5. The school was built in 1949 and remodeled in 1990 and was considered a model school within a diverse community. South Court has an API score of 866 and earned a California Distinguished School designation in 2006.[7] Unlike teachers at North Court who had access to a plethora of resources and materials, teachers at South Court did not have the assistance of outside professionals to assist them nor the funding needed to support professional development.

Sampling strategies

According to Onwuegbuzie and Leech (2007), selecting a sample size in qualitative research that is not too large allows a researcher to examine subjects' real perceptions, attitudes,

[5] Source: California Department of Education. Retrieved July 23, 2011, from http://www.cde.ca.gov/ta/

[6] Source: North Court School Accountability Report Card (2009). Retrieved July 23, 2011. (pseudonym).

[7] Source: California Department of Education. Retrieved July 23, 2011, from http://www.cde.ca.gov/ta/

and beliefs, and obtain a myriad of rich, authentic data that might not be possible to obtain from working with a larger or anonymous sample. One advantage of conducting this case study across two schools was that I was able to probe more deeply into the dimension of high and low wealth by focusing on each case individually and then analyzing the data across both sites.

Over the course of the study, I observed and interviewed the participants. I wanted to engage them in reflection that moved beyond what Schein (2004) refers to as espoused beliefs. Observations were meant to challenge teachers to reveal their underlying assumptions as inferred from their actions. Thus, by conducting in-depth interviews and multiple direct observations, I gained insight into the lived experiences of the teachers I studied.

Research participants

I used purposive criterion sampling to invite elementary school teachers to participate in my study. The process of identifying such participants was through conversations with the instructional leader and informal conversations with the nominees. Yin (2009) refers to this selection process as querying people knowledgeable about the participant. In total, I received fifteen nominations with assistance of two principals. That is, I was interested in studying teachers who were not only observed and interviewed by the researcher but were recommended by their supervisors as caring, engaged, and dedicated teachers, and I wanted to identify a spread of implementation quality within this spectrum (Murray & Jorgensen, 2007). I was not interested in working with novice teachers who I presumed would not be in a position to grasp differentiated instruction.

As recommended by Yin (2009), my focus was to inform the participants and protect human subjects in this study by gaining informed consent from all participants prior to the onset of the study, avoiding deception, maintaining privacy and confidentiality of those in the study, and obtaining written consent prior to onset of the study. Engaging participants within the organization meant creating a collective enterprise built on trusting relationships and collaboration based on the following criteria outlined by Coghlan and Brannick: (1) ensuring participants the right not to participate in the research, (2) promising confidentiality of information, identity and data, (3) keeping relevant others informed, (4) maintaining intellectual property rights, (5) getting permission to use documentation that was produced, and (6) evaluating the data on the basis of relevance in order to have confidence in the worth, validity and transferability of the data (Coghlan & Brannick, 1995). According to Herr and Anderson (2005), these criteria are important to apply because they help to ensure quality, validity, trustworthiness, credibility, and workability and describe criteria for quality case study research.

Data collection strategies

For this multiple-case design study, the data were collected using the following strategies: (1) researcher's classroom observations of participants' real-time classroom behaviors in action, (2) collecting documents from participants, (3) researcher's daily reflection through journaling and jotting down notes that occur in real-time when situations arise to check for bias, and (4) conducting individual interviews of the participants before and after the classroom observations. Figure 3 presents more specifics regarding data collection strategies.

Figure 3 – Data collection strategies

Data Collection Strategies	Frequency
Observing participants' behaviors in action	• A period of four months for nine selected teachers Approximately two times over a four month period • Approximately 30-50 minutes per observation (depending upon grade/lesson)
Collecting documents	• Documentation to include lesson plans, professional development agendas, notes, and other historical data available
Conducting interviews to understand the weight of personal factors in the strength of organizational conditions	• 18 structured interviews once participants are selected. Each participant will be interviewed two times during the study

Data collection strategies for this qualitative case study consisted of four cycles of inquiry: (1) initial observations and interviews of participants, (2) pre-observation interview, (3) periodic, informal interviews, and (4) post-observation/exit interview. Data were collected over four months with the purpose of building trust and rapport with each participant while gathering data. My purpose was to be able to probe more deeply into each case, ask meaningful questions that got beneath the surface of underlying assumptions and espoused beliefs (Schein, 2004), and collect quality data.

The first phase of data collection was the initial observation for screening purposes when I observed participants' visible behaviors in real-time to classify high and low implementers as determined by the level of implementation quality described earlier in this paper. This method enabled me to record patterns that existed as well as compare evidence to other data sources. According to Creswell (2007), observation protocols were developed for the purposes of summarizing, in a chronological fashion, the observation notes and flow of activities that occurred within each classroom.

The second phase of data collection was the pre-observation interview. Participants were interviewed to gather data on their knowledge of differentiated instructional practices and the organizational conditions they perceived to be of value. Interviews were conducted one-on-one with the researcher and were recorded and transcribed. All records were stored in a locked drawer in the researcher's office to ensure the confidentiality of the participants. Open-ended questions were used to gain in-depth information allowing the researcher to develop new questions that arose as a result of teachers' responses (Creswell, 2009).

During the third phase, participants were observed teaching a mathematics lesson by the researcher who documented evidence of behaviors associated with differentiating instruction as defined in context of this study (e.g. varied delivery of instruction, use of multiple resources and materials, and flexibly grouping students). In addition, I collected student work samples, teacher lesson plans, and student performance assessments for each observed lesson to provide context regarding the materials and resources employed by teachers to differentiate instructional practices in mathematics. I also kept a log of the dialogue in the classroom between the teacher and students to assess the level of implementation at which teachers were delivering instruction to meet the needs of each learner.

The fourth phase consisted of the researcher collecting data by engaging in formal interviews and informal conversations with each teacher participant. Interview protocols were used to assist in opening dialogue and building trust with each participant. A list of several

suggestions of ways to build trust with the teachers and reduce defensiveness was used during each interview (Appendix D). Any event or conversation related to the problem of understanding the personal factors, as a measure to check for the strength of the organizational conditions, was explored and further studied in the final interview. I also asked for documentation from faculty meetings to understand what conditions (e.g. quality of professional development) were employed to support teachers in the facilitation of differentiated instruction. Other sources, such as the district's strategic plan and goals, were used to understand influencing norms and values within the institution. These documents were used to analyze specific activities and opportunities for professional growth and may shed light on further training in the area of teaching mathematics, differentiating instructional practices, or both. Data from the classroom observations, participants' interviews, and documentation were triangulated and followed a replication logic with either similar or contrasting results (Yin, 2009) predicted and outlined in the context of this study. The use of multiple sources of evidence served to strengthen findings through what Yin (2009) refers to as "convergence of multiple sources evidence." The problem of construct validity was addressed through data triangulation because "the multiple sources of evidence essentially provided multiple measures of the same phenomenon" (Yin, 2009, p. 116).

Instruments

The major instruments employed in this study included observation and interview protocols. The Classroom Observation Scale – Revised (COS-R) was a tool to measure teachers' instructional practices against their expectations, and was derived from best practices in both mainstream and gifted classrooms (VanTassel, Baska, et al, 2003). This instrument was selected for use in this study primarily for its merit and foundation in theoretical bases from reform literature, general teaching practices, and literature on differentiation strategies. For purposes of this study, the scale was modified and revised to provide a guideline for observing and interpreting teachers' behaviors and personal factors. The first instrument used to observe and classify available participants who meet the criteria for implementation quality was the Teacher Observation Tool (TOT-Appendix F). The TOT scale was based on the conceptual framework of behaviors to be observed and explained in the areas of varied delivery of instruction (B1), use of multiple resources and materials (B2), and grouping students flexibly (B3). Teachers were rated using a Likert scale of 1-3 (1 = not observed, 2 = somewhat observed, 3 = effective). For example, an overall rating of three indicated a teacher implemented all three behaviors. A rating of "not observed" was also included because it was likely that not all behaviors were observed in a 30-50 minute lesson.

Additional teacher observation protocols included the Teacher Observation Protocol (TOP-1-Appendix H), and the Teacher Observation Protocol 2 (TOP-2-Appendix I). For TOP-1, the focus was on observable teachers' behaviors and teacher/student interactions. For the TOP-2, the focus was on observing the teachers' expectations for students, teachers' norms for student behavior, and teachers' skills and expertise in differentiating instruction.

Several interview protocols were used in the study and include the Teacher Pre-Observation Interview Protocol (TIP-1-Appendix G) and the Teacher Post-Observation Interview Protocol (TIP-2-Appendix J). Since this research data came about through the engagement of participants, it was important to capture information in a way that was not simply collecting data but generated learning data (Coghlan & Brannick, 2005). According to Patton (2002), there are three approaches to collecting data through open-ended interviews – each with

its own purpose: (1) the informal conversational interview, (2) the general interview guide approach, and (3) the standardized open-ended interview. Strategies for collecting qualitative data through informal and open-ended interviews were taken from Patton (2002) and can be found in Appendix E.

Data analysis

I anticipated fluid shifts in data collection and data analysis to occur in the process of systemically generating and collecting research data about the phenomenon, analyzing the data, and evaluating the results (Coghlan & Brannick, 2005). Once the data were collected, I employed the following formal and informal methods: (1) comparing and classifying the data for analysis, (2) sorting and coding the data by themes outlined in the conceptual framework, (3) gleaning comparative meta-matrices from the coded material (Miles & Huberman, 1994), (4) comparing categories in relationship to the conceptual framework and the literature, and (5) synthesizing the data to present findings (Creswell, 2007).

The first step was to organize the data from the observations and then transcribe and code the interview data looking for patterns and specific categories. I created and maintained a database in order to document findings, and proceed through the process of data reduction, data display, and drawing conclusions as recommended by Miles and Huberman (1994). One example of data reduction was the coding processes that occurred during the review of interview transcriptions. Interview transcriptions, notes from classroom observations, and documents reviewed were all included in the database so that strong associations could be drawn for the multiple sources of data. According to Yin (2009), using computer-assisted tools such as an organized and intelligible database increased the reliability of the entire case study.

Next, the data and findings were organized to support the research questions, hypothesis and conceptual framework outlined in Chapter Two. All findings were written in a narrative summary and displayed in a visual form (e.g. tables, matrixes) for each instrument used.

Issues of validity and reliability

Certain validity and reliability criteria outlined by Yin (2009) are common to judging the quality of case study research design. For this study, identifying operational definitions as outlined in Chapter Two ensured construct validity to explain the specific concepts of the study and how they related to the research questions. Validity was increased by using multiple sources of evidence (e.g. observation and interview protocols) and having peer reviewers critique the case study report (Yin, 2009). To bolster internal validity, I employed pattern matching across cases as a main strategy (Yin, 2009) and explanation building in pursuit of contrary explanations. Miles and Huberman (1994) assert that analytic manipulations can be done by: (1) putting information into arrays or matrixes, (2) creating displays, charts and other visuals, (3) chronologically ordering the data, and (4) tabulating the frequency of events and their relationships by calculating means and variances.

Reliability is enhanced through a planned and deliberate data collection process that allows other researchers to judge how the data were collected (Yin, 2009). For this reason, interview and observation protocols were created in principle to document similar patterns, with the goal of limiting errors and biases in the study. The information gleaned from the data was reported to provide a clear and organized summary of the findings. I used a Conceptually

Clustered Matrices, a tool that "clusters a few or even several research questions so that the meaning can be generated more easily" (Miles & Huberman, 1994, p. 110). My reason for displaying the data in this format was to see what the across-cases territory looked like so that I could validate my findings gleaned from the exceptional cases. In the across-cases analysis, I was less concerned with the unique patterns for each case and instead foregrounded the dimensions that related to all cases using the exceptional cases to provide analytical leads. A coding key for analyzing patterns is found in Appendix L with details of the rationale for coding: a plus sign (+) indicates a strong response in the data; a negative sign (-) represents data that showed a weak response; and the plus underline symbol (±) indicates a mixed or neutral response.

Avoiding bias, ensuring rigor

While subjectivity is natural and acceptable in case study research, mechanisms are needed to ensure that bias did not distort the outcomes (Herr & Anderson, 2005) of this study. I employed the strategy of member checking and secured a validation team to assist in dialogue regarding my interpretations. Fellow research colleagues served as peer examiners and critical friends to provide feedback for purposes of rigor, validity, and accuracy. I actively shared observation and interview notes with my colleagues to avoid bias. Together we reviewed the results of the data to identify potential inconsistencies in data collection. During debriefing sessions, colleagues were a vital sounding board to help me step back from the data to more thoroughly understand what was occurring and to assist me by challenging contradicting information regarding my analysis and conclusions (Herr & Anderson, 2005). They also provided an opinion as to whether the data collection and analysis was presented in a clear and accurate manner (Creswell, 2009).

Timeline and activities

From the onset of this study, I operated under the premise that organizational conditions are malleable, and to some extent, an area where instructional leaders could influence their organizations. I expected that particular organizational conditions may require change in order to facilitate differentiated instructional practices. I also presumed that personal factors are less likely to be influenced, yet are still vital and integral in assessing the full picture of this research methodology. Figure 4 is a detailed timeline of the activities conducted in this research study.

To summarize, the findings are a compilation of the observed and quantifiable behaviors for level of implementation quality among teachers rated high or low. Additionally, narrative and descriptive data collected in a variety of ways were used to assess organizational conditions and personal factors. Since qualitative studies often tell a story, the final results are presented in a descriptive, narrative manner. The findings represent an understanding of the problem and are a construction of the experiences of the participants, aligning their stories with theory and assumptions outlined in Chapter One. In a future research project beyond this one, these findings may be useful for application in other content areas and for other elementary school and district settings.

Figure 4 – Timeline and activities

Timeline	Activities
December 2010	• Informal observations and initial meeting with teachers to seek participants and gain informed consent
December 2010-January 2011	• Interview teachers to gather baseline data regarding personal dispositions and instructional strategies for facilitation of curriculum differentiation
January-April 2011	• Classroom observation in each elementary classroom (appx. 30-50 minutes each) • Post observation interview for each of the participants
April –May 2011	• Final interview to deepen my understanding of the personal factors and organizational conditions that facilitate curriculum differentiation

My role

This study utilized narrative and qualitative methods of data collection while taking into account my conviction that curriculum should be differentiated to meet the diverse needs of students within a classroom. I was conscious of employing mechanisms for dealing with biases, as well as establishing protocols to mitigate the power relations that exist between me, as a superintendent in a not-so-distant district, in collaboration with others educators. I further understood that bias and experiences threaten or challenge the researcher's understanding of the problem (Herr & Anderson, 2005). I needed to grasp the challenges regarding the institutional micro-politics such as behind the scenes negotiations for materials and resources, vested interests, and power differences that may have existed within an organization in order to understand the threat to this study's validity. Therefore, a goal was to have upfront, clear working agreements and relationships early in the process (Herr & Anderson, 2005) in order to address issues of trust and reluctance. As mentioned earlier, my role was explained to the participants as one of service for helping and not evaluating them. The agreement was defined as having a shared understanding that as educators, we are working together committed to making schools and districts better organizations focused on teaching and learning.

The purpose of this case study was to understand key organizational conditions that facilitate differentiated instruction in mathematics. To recap, I have outlined the problem, reviewed the relevant theoretical literature, explained the conceptual framework, introduced the research design and methodology, and discussed issues of handling and strategies related to this research study. In the next chapter, I present my findings.

CHAPTER IV. FINDINGS

Introduction

In this chapter I analyze the nine cases selected for this study. These cases are a selection of nine volunteer participants from two different suburban elementary schools, the North Court School and South Court School.[8] My analysis involved two key steps that I summarize in this chapter. My first step was to create a detailed list of observed teaching practices in order to classify each participant in a range between high and low implementation quality. The result of this procedure was the identification of one exceptionally high implementer and one exceptionally low implementer within the nine-case selection. These two cases were then selected for an in-depth analysis. I examined these two case studies individually, drawing upon observed classroom and teaching practices so I could identify the factors and conditions associated with the high or low implementation of differentiated instruction. I explored how observed practices were shaped by each participant's personal beliefs, attitudes and experiences, as well as how the participant perceived herself within the organization. Next, I compared observed behaviors and interview data from the two exceptional cases and looked for patterns and practices to isolate specific factors and conditions that stand out as having made a difference for high or low implementation of differentiated instruction.

My second step was to 'analyze for fit' the remaining seven cases into the patterns identified in the exceptional cases. This enabled me to move beyond the uniqueness of the two exceptional cases and extend patterns to the continuum of all nine cases. Patterns are corroborated to the degree that they fit all nine cases. Finally, I extract from this analysis which unique personal factors and organizational conditions may facilitate the ability of teachers to engage in high implementation of differentiated instructional practices.

Descriptive Information about Selected Cases

Prior to collecting any qualitative data, teachers were informed of the selection and screening process, and were asked to review and submit a signed copy of the consent form, which outlined the purpose of the study. The original purposive sample of nine teachers for this study was drawn from fifteen volunteer nominees from two different schools. Five teachers of total sample size in grades K-6 volunteered and were selected from North Court School, and four teachers of total sample size in grades K-5 volunteered and were selected from South Court School.

These two sites were selected according to key criteria. Most importantly, both sites shared a similar vision and explicit commitment to the practice of differentiated instruction as a strategy for meeting the diverse needs of students in mixed-ability classrooms. At the same time, differences in student population and in per pupil spending ensured some organizational contrasts that would inform my research most notably with regard to resource availability.

North Court School is located within a high wealth, basic aide district,[9] rich with resources and opportunities for students since funding is based on local property tax revenue and

[8] All program and people's names have been changed to ensure anonymity and confidentiality.

[9] Basic aide districts are referred to as districts to by some legislators as "excess revenue" or "high wealth" districts. These districts are allowed to keep revenue from their excess property taxes. Source: Edsource. Retrieved July 23, 2011, from http://www.edsource.org/1079.htm

a strong educational foundation that contributes 25% of the overall operating budget. Spending per student is approximately $16,500 per year.[10] In contrast, South Court School is classified as a school within a low-wealth[11] district. Spending per student is approximately $4,800 per year with fewer resources and opportunities for students as compared to North Court.[12] My visits to the individual school sites confirmed my original criteria for selecting these two unique sites.

Early on in the study, six volunteer nominees from the original ten at South Court School decided not to participate due to professional time constraints. Of the remaining participants, only one participant was male. Since I did not seek to examine the role of gender in teaching practices, fictitious female names were given to all participants selected to protect the identity of the male teacher. Figure 5 and Figure 6 represent backgrounds of each teacher including grade level taught, site description, years of experience teaching, and information on training.

Figure 5: Backgrounds of participants by grade level and years of experience

Teacher	Current Grade Level							Years of Experience		
	K	1	2	3	4	5	6	0 - 9 yrs.	10 -19 yrs.	20+ yrs.
Dana	✓								✓	
Fran		✓								✓
Fiona			✓						✓	
Lisa					✓					✓
Hali	✓								✓	
Lara			✓						✓	
Sade				✓				✓		
Ria					✓				✓	
Nina							✓	✓		

In describing the characteristics of each participant, I looked for commonalities and differences in order to isolate the two exceptional cases for this study and to eliminate any outliers. Only one teacher, Nina, received any formal training in mathematics, and no teacher received any formal pre-service training in differentiated instruction. I looked for two teachers who were as similar as possible in as many characteristics as possible, but differed remarkably in implementation quality. This step allowed me to highlight personal differences with regards to experience among the two teachers. I then followed up this analysis with a comparison of all nine teachers in both resource-rich and resource-poor working conditions as depicted in Figure 7 to determine if I could isolate the two cases for in-depth analysis which met the criteria for high and low implementation of differentiated instructional practices. For example, I learned that while the teachers at North Court had more resources available to them, there was not one teacher who was provided with additional personal assistance (e.g. an aide) during classroom time to support implementing differentiated instruction.

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[10] North Court School Accountability Report Card (2009). Retrieved July 23, 2011. (pseudonym).

[11] A low wealth school district traditionally is a district that receives less money than the statewide average revenue limit. Source: Association of Low Wealth Schools. Retrieved September 4, 2011, from http://www.associationoflowwealthschools.org/about.php.

[12] Source: South Court School Accountability Report Card (2009). Retrieved July 23, 2011. (pseudonym).

Figure 6: Description of participants by school and characteristics

Characteristics of Teacher Participants	South Court School				North Court School				
	Dana	***Fran***	***Fiona***	***Lisa***	***Hali***	***Lara***	***Sade***	***Ria***	***Nina***
Grade level taught	K/1	1st	2nd	4th	1st	2nd	3rd	4th	6th
Number of students in current grade	12	11	30	30	15	21	21	21	22
Type of district *(L=Low wealth; H= High wealth-basic aide)*	L	L	L	L	H	H	H	H	H
Number of years of teaching experience	10	29	15	30	7	15	5	10	4
Number of years teaching current grade level	2	20	1	1	5	5	3	9	1
Type of credential *(M=multiple subject; S=single subject*)	MS	MS	MS	MS	MS	MS	MS	MS	SS *Math*
Have you received any pre-service training in mathematics?	N	N	N	N	N	N	N	N	Y
Have you received any pre-service training in teaching differentiated instruction?	N	N	N	N	N	N	N	N	N

Figure 7: Description of participants by school and resources

Access to resources & materials for implementation of differentiated instruction Y = Yes N = No	South Court School				North Court School				
	Dana	***Fran***	***Fiona***	***Lisa***	***Hali***	***Lara***	***Sade***	***Ria***	***Nina***
Type of district *(L=Low wealth; B=High wealth, basic aide)*	L	L	L	L	H	H	H	H	H
Access to technology for teacher use	Y	Y	Y	Y	Y	Y	Y	Y	Y
Access to technology for student use	N	N	N	N	Y	Y	Y	Y	Y
Access to additional math manipulatives	N	N	N	N	Y	Y	Y	Y	Y
Access to additional math visual aides	N	N	N	N	Y	Y	Y	Y	Y
Access to additional math books, charts	Y	Y	Y	Y	Y	Y	Y	Y	Y
Access to personal assistance during classroom instruction (e.g. aide)	N	N	N	N	N	N	N	N	N
Access to math coach	N	N	N	N	Y	Y	Y	Y	Y
Access to professional development	N	N	N	N	Y	Y	Y	Y	Y
Access to common planning time	N	N	N	N	Y	Y	Y	Y	Y

Qualitative data collection procedures and instrument used

As part of the initial selection process, each of the nine volunteer participants was observed teaching mixed-ability students in elementary mathematics in her classroom. During my first classroom visit, I took anecdotal notes of what I observed during the lesson, and used the Teacher Observation Tool (see Appendix F) referenced in Chapter Three to capture teaching behaviors. This tool was created based on my conceptual framework and honed in on specific instructional behaviors indicating implementation quality of differentiated instruction and generic ones indicating instructional quality more generally. The purpose of this process was fourfold: (1) to observe behaviors of the participants and record patterns across the selected cases; (2) gain descriptive data on teacher practice; (3) witness the level of differentiated instructional practices being delivered to students; and (4) determine a continuum of

differentiated instruction implementation quality across the nine cases. The extreme ends of the continuum would be my "exceptional" cases for in-depth analysis.

As explained in Chapter Three, I looked at three criteria taken from the literature for classifying behaviors for high implementers: (1) varied delivery of instruction, (2) use of multiple resources and materials, and (3) ability to group students flexibly. I then examined whether or not each participant was observed implementing such practice in order to classify each participant as high or low. Finally, I was able to select the two exceptional cases of high and low implementation.

I found this process of documenting notes and using the tool a very useful way to record my observations. During my visits to each classroom, I jotted down any behaviors that I witnessed by checking the appropriate box on the tool. In Figure 8, I captured the broad types of practices that were observed as a means to evaluate the quality of implementation practices for differentiated instruction across all nine cases. An overall score of six, seven, or eight indicated that a teacher was observed engaging in all three of the classifying behaviors for high implementation noted above, and then was classified as a high implementer. A rating score of one or two indicated a teacher did not meet the criteria for high implementation quality. A mark of 'not observed' was also included if the behavior was not observed during my visit.

Identification and selection process

As a next step, I analyzed the data of observed behaviors and looked for two participants with varied degree of implementation quality: an exceptionally high and an exceptionally low implementer. During the first phase of analysis, I classified the participants and determined two participants were average implementers (e.g. Dana and Fiona), six participants were high implementers (e.g. Fran, Lisa, Hali, Lara, Sade, and Ria), and one participant, Nina, was classified as an exceptionally low implementer. Holding school and district context constant, I searched for a high implementer at North Court that was a good match to the sole low implementer. There were four who could be considered: Hali, Lara, Sade and Ria. Sade was selected for the in-depth case analysis because she had the most similar context and characteristics as Nina, the low implementer. For example, as presented in Figure 9, Sade and Nina had nearly the same number of years of teaching experience, similar class sizes, and placement at North Court School. Sade, a third grade teacher, had been teaching for five years, and Nina, a sixth grade teacher, had been teaching for four years. A review of Figure 8 confirmed Sade was observed engaging in more differentiated practices and classified as the high implementer, and Nina was thus classified as the low implementer.

The fact that both worked in a resource-rich environment at North Court School would make it possible to see how these teachers with contrasting levels of implementation quality might utilize personal resources and relate differently to the wealth of material and support that was commonly available to both of them. As previously mentioned, North Court School is a K-8 school serving mostly an upper socioeconomic community with approximately 360 students. Property values are either high due to the district's high performing status or vice versa. In either case, this has brought much notoriety and outside validation to the school and district. At the time of this study, test scores over the previous ten years had all been well over the state average and in the upper quadrant for public schools.

Figure 8 - Participant selection evaluation based on screening criteria

Differentiated teaching behaviors and characteristics observed and explained	**Frequency Scale 1-8**								
	South Court School				**North Court School**				
The teacher…	***Dana***	***Fran***	***Fiona***	***Lisa***	***Hali***	***Lara***	***Sade***	***Ria***	***Nina***
B1 = Varied delivery of instruction Engaged students in planning, monitoring, or assessing their own learning	✓	✓	✓	✓	✓	✓	✓	✓	✓
Encouraged students to express their thoughts	✓	✓		✓		✓	✓	✓	
Had students reflect upon what they learned			✓	✓	✓	✓			
Incorporated activities for students to apply new knowledge		✓		✓	✓	✓	✓	✓	
B2 = Used multiple resources and materials (MR) Accommodated individual and subgroup differences (e.g. through student or teacher choice in material selection and task assignment		✓	✓	✓	✓	✓	✓	✓	
Encouraged multiple interpretations of events and situations through use of materials/resources	✓	✓			✓		✓	✓	✓
B3 = Grouped students flexibly Provided opportunities for independent or group learning to promote depth in understanding content	✓	✓		✓	✓	✓	✓	✓	✓
Accommodated individual and subgroup differences (e.g. through individual conferences)		✓	✓	✓	✓	✓			
Total Score (1-8)	**4**	**7**	**4**	**6**	**7**	**7**	**6**	**6**	**2**
RATING (1 = low; 2=average; 3=high)	**2** Avg.	**3** High	**2** Avg.	**3** High	**3** High	**3** High	**3** High	**3** High	**1** Low

Upon my first visit entering the main building, I noticed that the display case in the reception area was filled with visible proof of excellence such as academic awards from various groups including county awards for mathematics competitions, and the distinction of being selected as a California Distinguished School. As reported on the school's Accountability Report Card,[13] the school had a long-standing reputation of dedicated supportive staff, parents and community partnerships, and encouraged parents to be involved with making educational decisions by volunteering for one of 23 active committees at North Court. Similarly, all teachers

[13] Source: North Court School Accountability Report Card (2009). Retrieved July 23, 2011. (pseudonym).

were highly qualified by No Child Left Behind (NCLB) criteria, and were fully credentialed in their field.[14] The teachers and staff I spoke to were pleasant and seemed proud of their school as evidenced in their welcoming manner towards me and the informative conversations we had about the school.

Figure 9: Description of exceptional high and low implementers

Characteristics of Teacher Participants	North Court School	
	Sade	***Nina***
Grade level taught	3rd	6th
Number of students in current grade	21	22
Type of district *(L=Low wealth; B=Basic Aide)*	B	B
Number of years of teaching experience	5	4
Number of years teaching current grade level	3	1
Type of credential *(M=multiple subject; S=single subject*)	MS	SS Math
Have you received any pre-service training in mathematics?	N	Y
Have you received any pre-service training in teaching differentiated instruction?	N	N

Through informal conversations with the principal, I was aware that North Court School prided itself on providing individualized attention. The principal told me that the school had focused on differentiating instruction as means of meeting the needs of diverse learners for over a decade. The principal and administrative team were fairly new in their roles and they espoused a different philosophy that made meeting the unique needs of learners and differentiating instruction a mandatory quest. The school's principal implemented Response to Intervention ('RTI')[15] as a framework for differentiating instruction for grouping students across the grade by ability for mathematics starting in fifth grade. This framework included a mix of tracking learning groups into fairly homogeneous groups so that teachers would answer to a reduced spectrum of individualized needs. This practice was in contrast to how students were grouped in grades kindergarten to fourth grade where they were grouped heterogeneously even though all teachers were expected to individualize instruction through differentiated instruction using a RTI framework. I was fascinated to learn more about the impact of the RTI approach on the implementation quality and how this organizational change would impact Nina and Sade. When I asked the principal to explain the rationale regarding her philosophy about differentiated instruction and the RTI framework, she stated:

> The unique cohort group of students lends itself to a rich academic educational environment. RTI provides a framework for success,

[14] Source: North Court School Accountability Report Card (2009). Retrieved July 23, 2011. (pseudonym).

[15] Response to Intervention (RTI) is a multi-tiered approach and holds the promise of ensuring that all children have access to high quality instruction, and that struggling learners – including those with learning disabilities – are identified, supported, and served early and effectively. Students' progress is closely monitored at each stage of intervention to determine the need for further research-based instruction and/or intervention in general education, in special education, or both. Source: RTI Action Network. Retrieved July 23, 2011, from http://www.rtinetwork.org/learn/what

> support, and extensions that have the potential to change the way we address and support differentiation in our school. This framework holds great promise in ensuring that every teacher will assume responsibility for the success of every child. The success hinges on our ability to elevate the role of the classroom teacher while offering carefully coordinated support and enrichment options designed to extend that role. In RTI, thoughtful differentiated instructional experiences rise from varied assessments and professional collaborations designed to flexibly meet the unique needs of students. RTI is a powerful framework of coordinated efforts based on instructional responsiveness and differentiation. (Principal, personal communication, March 3, 2011).

The principal believed this organizational change would be transformative for teaching and learning; teachers would have a greater success in meeting the unique needs of each student and differentiating instruction under this framework.

The question I asked myself was: would this reduced heterogeneity in sixth grade in combination with a resource-rich environment with additional resources and support facilitate high implementation of differentiated instruction as compared to third grade? Since the community valued high expectations for students, I assumed the same expectations existed for its teachers. This study set out to see if such a school equipped with ample financial resources to support students and staff allowed for organizational change to improve teacher practice.

Summary

To sum up, I selected Nina and Sade because of how they fit into my in-depth contrasting case analysis with the following four similar criteria as depicted in Figures 6 and 7: type of school (e.g. high-wealth); similar class size; years of teaching experience; and no formal training in differentiated instruction. The contrast in level of implementation quality between the two cases allowed me to highlight personal factors contributing to high and low implementation of differentiated instruction in mathematics, as well as potentially differing ways of relating to organizational resources and support. My findings from the contrast between these two cases provide a basis to analyze patterns across all nine cases.

Case #1 – The High Implementer

At the time of this study, Sade, a third grade teacher at North Court School, was amongst a pool of six participants (depicted in Figure 8) selected for this study who were classified as high implementers of differentiated instruction. While Sade possessed many attributes associated with other high quality teachers selected for this study, the reason she was selected for the in-depth analysis was that she had the most similarities to Nina, the low implementer (depicted in Figures 5, 6 and 7). In this section, I begin by highlighting Sade's professional and educational experiences and my observations of her teaching practices first in more generic terms as a high quality teacher. Then, I describe the practices I observed in her teaching mathematics and implementing differentiated instruction. Next I describe personal factors, specifically Sade's

personal beliefs, attitudes and experiences. I follow up with Sade's perceptions about the organization and leadership as documented in my interviews with her.

Observed behaviors and differentiated instructional practices in mathematics for the high implementer

A review of the literature identified generic characteristics of a high quality teacher. Such teachers have a reputation among parents and colleagues of being teachers of high quality. They are willing to give of themselves and care deeply about students; have the ability to organize and manage a diverse group of students; embrace high expectations for students, diversity, and heterogeneity; use differentiated instructional practices for meeting the needs of students; possess high content knowledge and skill teaching the subject matter; and generally enjoy teaching students (Darling-Hammond, et al 2005; Gardner 1983, 1991, 1993; Gay, 2002; Montgomery, 2001;Vgotsky, 1978). These attributes I identified as high quality teaching from the literature were characteristic of Sade and her teaching practices.

Through my informal conversations with the principal, I heard that Sade was one of those rare and talented teachers who cared about her students both academically and personally; she was often requested by parents and was well-liked by students, staff, parents and colleagues. From my initial meeting with Sade, I sensed a calmness and confidence in both her mannerisms and words. Sade was not only a sweet, calm, and gentle person but she was also eager to assist me in this study, and I was pleased to work with her.

Sade became an elementary school teacher soon after obtaining her multiple subject teaching credential.[16] She received her bachelor's degree and teaching credentials from a local university. She had been teaching for five years and held positions as a first and third grade teacher. At the time of this study, Sade was assigned to teach third grade, once again, after being reassigned for one year to teach first grade. She had twenty-one students in her third grade class. Her students ranged in ability from those who were identified as special education to those identified as gifted and talented (Sade OBV[17] – March 3, 2011). As stated earlier, students in grades kindergarten to fourth grade were not tracked into homogenous groups but instead were grouped heterogeneously.

During my classroom observation of Sade's teaching, Sade created a safe environment for all her students as evidenced by her friendly and enthusiastic gestures, warm comments and smiling eyes, and her students apparent comfort level in interacting with her and each other. She often began a question by praising her students first for their hard work. For instance, during the geometry lesson I observed, she commented:

> You have done a great job looking at the book. I want you to think back to 2nd grade. What is an octagon? (Sade INT[18] – March 3, 2011).

[16] Elementary (Multiple Subject) Teaching Credentials authorize the holder to teach in self-contained classrooms such as classroom settings in most elementary schools. However, a teacher authorized for multiple subject instruction may be assigned to teach in any self-contained classroom (preschool, K-12, or in classes organized primarily for adults). In addition, the holder of a Multiple Subject Teaching Credential may serve in a core or team teaching setting. Source: Commission on Teacher Credentialing. Retrieved December 30, 2011, from http://www.ctc.ca.gov/credentials/CREDS/elementary.html

[17] OBV = Observation

[18] INT = Interview

Sade was an eager, conscientious communicator who facilitated clarity through her words and actions. For example, during my classroom observation, Sade spent a great deal of time articulating her expectations, asking questions, circulating around the room, and checking for understanding. She clearly communicated her expectations to the students and introduced the lesson in the following way.

> I need you to think about geometry? Ready, ready…what is a rectangle? (Students raised their hands and responded.) You are using vocabulary really well. What is a quadrilateral? (Sade INT – March 3, 2011).

Sade was also skilled at managing the classroom and her students by setting limits, creating inclusivity, and providing structure. Sade's exemplary classroom and behavior management skills were evidenced by her manner of keeping students engaged during my observation. Specifically, student desks were organized into groups of four with students participating in hands-on and problem-based learning activities. During my observation of her teaching mathematics, Sade and her students appeared quite comfortable in their setting learning about geometry. Sade's facial expressions, voice inflections, and general movement around the room appeared to hold the attention of her students who were self-motivated and who effortlessly moved about the classroom to complete their assignments.

Sade's work with her students also demonstrated competency teaching the subject matter content based on the evidence gathered during my observation of her carefully constructed and purposeful lesson. As shown in Figure 10, I assembled specific examples summarizing Sade's understanding of the complexities of teaching mathematics in a mixed-ability classroom (Sade OBV, March 3, 2011). Sade not only demonstrated knowledge of subject matter content and student development, but she was also able to organize and teach her lesson in ways that ensured each student learned the subject matter. For example, she was able to assess student learning during her delivery of a spiral review of mathematical concepts to support the multiple skills needed for master of geometry. Overall, Sade's positive attitude and personal touch provided the type of learning environment that felt much like a family and place of belonging. Sade not only exhibited the qualities of a good teacher who took special care to maintain an emotionally safe classroom, but she knew how to create an environment focused on learning. When I asked Sade what she was trying to accomplish by differentiating her lesson, Sade responded:

> I want them to be able to have a couple of different strategies on how to solve the problem as it happens. (Sade INT – March 3, 2011).

Sade also demonstrated skill and expertise in differentiating instruction in mathematics in various ways. Sade established routines and set parameters for the workspace by grouping students to facilitate the use of manipulatives during the lesson. This differentiated instructional strategy facilitated an environment where students may benefit from the variety of method and support provided regardless of ability level. For example, Sade used flexible grouping[19] and

[19] Flexible grouping is a one of the foundations of differentiated instruction and a hallmark of an inclusive classroom environment. Sometimes students work with like-readiness peers, sometimes with mixed-readiness groups, sometimes with students who have similar interests, sometimes with students who have different interests, sometimes with peers who learn as

hands-on activities as two differentiated instructional approaches that provide students with several options for taking in information and making sense of ideas about geometry. Sade described the activity to her students as follows:

> With your partner, you are going to create geometrical drawings. Each group will get a bag of rubber bands, a geoboard and paper. One person will draw the shape on the paper when I call it out and the other person will make it on the geoboard. Then you will switch. (Sade OBV - March 3, 2011).

As stated in a Chapter Two, using group dynamics and manipulatives to teach mathematics is consistent with theories on how students best learn mathematics.

Further, Sade demonstrated knowledge of the subject matter and understanding of student development by scaffolding[20] her lesson to include a review of geometry terms and use of a video on aquariums to make the subject matter accessible to her third grade students. After introducing the new concept of geometry and showing the video, Sade asked her students:

> You all have a note card on your desk to write down your answer. Who can tell me one thing you learned about the video? (Sade OBV – March 3, 2011).

After the students wrote down their individual responses, Sade called upon her students to check for understanding. She followed up with another hands-on activity utilizing the same note card and foam shapes to reinforce the cognitive complexity of geometry thereby considering the needs of auditory, visual and kinesthetic learners within her class. The significance in teaching geometry using this differentiated approach is that it helped to develop different ways of thinking beyond the basic knowledge of mathematics by using visual representation and reasoning ability. Through an inclusive learning environment, she encouraged her students to participate and demonstrate their understanding. She taught in a way that was responsive to individual student readiness level by asking the following question:

> Now turn your card over and cover the entire card with the foam shapes I provided. How is this shape different from the note card? (Sade OBV – March 3, 2011).

In this example, Sade differentiated the lesson not only by content, but process and product as well. Sade had the ability to articulate a mathematical concept several different ways until her students understood what was expected. She knew how to relate to her students using a variety of skills and resources to explain the content and thus created a safe environment where students

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they do, sometimes randomly, and often with the class as a whole. Source: Tomlinson, C.A. (2000). ERIC Digest: EDO-PS-00-7. Retrieved December 30, 2011, from http://ceep.crc.uiuc.edu/eecearchive/digests/2000/tomlin00.pdf

[20] Instructional scaffolding is the provision of sufficient support to promote learning when concepts and skills are being first introduced to students. These supports may include the following: resources, a compelling task, templates and guides and guidance on the development of cognitive and social skills. Source: Wikipedia. Retrieved: December 29, 2011, from http://en.wikipedia.org/wiki/Instructional_scaffolding

were allowed to make mistakes. For example, Sade walked around the room and actively collected and assessed student work, all the while being able to deconstruct the language of mathematics. When one group of students did not understand how to use a geoboard[21], Sade walked over to the students, explained how to use the geoboard, and modeled what was expected. Sade described teaching the mathematics curriculum in this way as enriching:

> Ideally, it would be nice if they (the students) could do something hands-on each day and create something. The program comes with an enrichment piece and so I usually rely a lot on that, but it's just a worksheet. But, today's lesson, there was actually an enrichment part that they (the students) could build – make an aquarium on their own. It doesn't require another teacher coming in and pulling a group into the hallway. It's something all kids can do together in class and is still enriching. (Sade INT - March 3, 2011).

Sade articulated the benefits of using hands-on activities to teach and the importance of making sure her students understood the mathematical concepts. When I asked Sade to tell me how she knew her students were learning mathematics and how she assessed her students, she described her process:

> So I do little informal daily assessments. So I'll teach the lesson and throughout the lesson, I have them use their whiteboards. And they will show me informal assessments, and then there's the weekly test. I correct their homework right after they do it. And that's a good measure, I guess, to tell them that they need to work on it. But also too, I think problem solving is huge. If they can be able to explain something to me, then I know that they really understand it. (Sade INT - March 3, 2011).

Several weeks later, I asked Sade, "Why do you think teaching mathematics in a mixed-ability classroom is different from other content areas?" She replied insightfully:

> Well, a lot of math concepts are very developmental. I think out of all the subjects or out of all the content areas, math is definitely the area where you need to differentiate the most, because of how many developmental different skills and concepts there are. (Sade INT - April 26, 2011).

Sade's response to my probing queries not only corroborated my findings that she understood how to teach mathematics to her third grade students, but I also observed her techniques to differentiate instruction as a practice to ensure each child's needs were being met.

[21] A geoboard is a mathematical manipulative often used to explore basic concepts in plane geometry such as perimeter, area or the characteristics of triangles and other polygons. Consisting of a physical board with a certain number of nails half driven in, in a symmetrical square five-by-five array, students are encouraged to place rubber bands around the pegs to model various geometric concepts or to solve other mathematical puzzles. Source: Wikipedia. Retrieved January 5, 2012, from http://en.wikipedia.org/wiki/Geoboard

Figure 10 – Evidence of Sade's observed behaviors and differentiated instructional practices for high implementation

Expectations for students	***Evidence observed during classroom observation***
1. Connects students' prior knowledge, interests and life experiences with learning goals of the lesson	Sade asked clarifying and inquiry-based questions that engaged students and activated learning.
2. Uses a variety of instructional strategies and resources to respond to diverse needs	Sade used a video, geoboard and other manipulatives to respond to students' abilities when reviewing concepts and skills about geometry.
3. Articulates short-term and long-term goals for individual and group work	Sade began her lesson by articulating the lesson objective and goals for the day.
4. Facilitates learning experiences that promote choice	Sade provided several choice activities such as challenge activities using the geoboard and provided enrichment activity of building an aquarium.
5. Promotes self-directed, reflective learning for all	Math folders were developed to support self-directed problem solving activities.
6. Commits to providing equitable learning experiences	Sade provided opportunities for small group (table group) and peer-to-peer interactions and independent learning.
Teacher's norms for student behavior	***Evidence observed during classroom observation***
7. Establishes a climate that promotes fairness and respect with a focus on teaching/learning of mathematics	Sade mastered classroom management skills that incorporated the use of a positive attitude and gestures to ensure all students were equally represented and participated. Sade had the ability to "catch students doing things right" rather than doing things wrong.
8. Answers questions when needed and uses time efficiently	Sade provided time in her lesson to check in with each student.
9. Creates a physical environment that engages all students	Sade asked students to reflect about the video and asked questions about what they learned about the aquarium and geometry.
10. Establishes and maintains standards for student behavior that support student learning	Sade's ability to engage all students empowered students to work independently in a high level academic environment with no behavior issues.
Skills and expertise in differentiating instruction in mathematics	***Evidence observed during classroom observation***
11. Demonstrates knowledge of subject matter content and student development	Sade scaffolded her lesson to include a review of geometry terms and perimeter.
12. Establishes routines for beginning and ending class; changing workstations; sets parameters of workspace and time; and collecting/returning student work	Sade asked her students to choose to complete the challenge activities using the geoboards once they completed their daily work.
13. Organizes curriculum to support student understanding of the subject matter	The lesson can be characterized as a spiral review of mathematical concepts to support multiple skills for mastery of the subject matter.
14. Provides clears directions for auditory, visual and kinesthetic learners (e.g. utilizes task cards, charts, white boards, peer helper, etc.)	Sade provided students with math manipulatives, and utilized an interactive white board, video, geoboards, and challenge work geared to self-paced activities.
15. Uses materials and resources to make subject matter accessible to students	Sade modeled mathematical concepts using additional resources and technology that included an interactive white board, video, and geoboards.

Personal factors: beliefs, attitudes and experiences of the high implementer

Sade was one of five teachers at North Court School who volunteered to participate in my study. She not only was kind-hearted but genuinely interested in learning more about how to improve her teaching of mathematics and implement more lessons that were differentiated. During the screening process, my conversations with Sade were informal as I observed her teaching a mathematics lesson in order to determine her level of implementation quality. After the screening process, I met with Sade and conducted my first formal interview, asking her general questions about her teaching experience, educational background, philosophy and beliefs about students and teaching mathematics. During this initial interview, I was also interested in learning about the skill level of her students and the challenges she found in teaching a mixed-ability classroom. When I asked Sade to comment on both skills level and challenges, she replied:

> For me, it's a challenge dealing with – I have two students who require one-to-one attention. When they're in the room, it's difficult to, one, keep them engaged while I'm doing direct instruction, so that's a difficult time for them. And then having enough time to meet to just sit down and meet with them individually, while at the same time not neglecting the needs of the other students. (Sade INT – March 3, 2011).

During the interviews, I noticed that the more the discussion turned to students and teaching, the broader Sade's smile became.

I followed up with a classroom observation of her teaching and an additional interview. During the second interview, I asked Sade specific questions regarding what I observed while visiting her classroom. Many of Sade's responses provoked deeper questioning on my part as I probed her perceptions of her own teaching and the school organization. Every time I encountered Sade and engaged in discussion, Sade spoke to me with great enthusiasm as if my interviews were the most important event of the day.

Looking back to my first interactions and conversations with Sade and the principal, I can see why Sade had a reputation of being such high caliber. She possessed a strong sense of efficacy and readiness to transform her teaching practice. In her words and observed behaviors, she demonstrated a commitment to her students by creating a responsive environment that capitalized on each student's strengths and focused on learning. Sade's description of her teaching diverse students was captured as follows:

> I have some students who are unable to work independently at all with math. I need to be there to help. So, that's one extreme. And there are all different levels in here. There are students who can work independently, that definitely need the extra challenge. It's every day and incorporated into my lesson. I have to make sure to provide it all. Right now, the way it works, if the students are struggling, I'll put them in a small group at different times throughout the day when other students are working (Sade INT – March 3, 2011).

Sade's strong passion and belief in her students were apparent in her classroom and during our interviews. When I asked her what she believed every third grade student needed to know to be successful in mathematics, she described her hopes inside the challenges of teaching a mixed-ability classroom:

> I want them to be able to problem solve at a third grade level. To be able to read a problem, understand it. I think it's important to not pull all my attention on the students who need that one-on-one attending but to be aware of how really to distribute my time evenly throughout the group. (Sade INT – March 3, 2011).

With only five years of teaching experience, Sade was mindful of the different needs of her students. After several informal conversations, I also learned that Sade was part of the community, having been born and raised in the same county. She understood where her students came from in terms of their home life and family dynamics. She used this understanding to focus on each child individually to meet his/her unique needs.

Sade described herself as a life long-learner who continually sought ways to learn either formally or informally. For her, skills and content knowledge grew with experience. She expressed this in saying:

> I think how I've learned most is just experience and just kind of observing other teachers, and then diving into the curriculum and just getting comfortable with the curriculum. (Sade INT – March 3, 2011).

As in developing any new skill, she was able to become more confident and proficient teaching mathematics with experience and the right attitude. What Sade lacked in years of experience she gained through her willingness to persevere, practice what she had learned, grow from her mistakes, and ask for help when needed. Sade summed up her thoughts about learning about mathematics and training as:

> I didn't learn about it in my credential program, so I think it's up to us as teachers now to expand our education and look for different ways to do that. (Sade INT – April 26, 2011)

As previously stated, Sade integrated differentiated instruction as a practice into her daily teaching because she believed it was the right way to teach mathematical concepts that were developmental and required different skills to learn (Sade INT - April 26, 2011).

Organizational conditions: high implementer's perceptions about the organization, resources, and organizational leadership

During her tenure at North Court School, Sade took advantage of opportunities and resources that were available to her for the benefit of her students. The following excerpt from an interview with Sade typifies her positive views regarding the resources available to her within the organization to improve her practice of differentiating instruction. She said:

> I feel pretty supported as far as financial. If I were asked to attend a workshop or purchase materials, I feel like nine out of ten times, I would be granted the opportunity. (Sade INT - April 26, 2011).

Moreover, she was a resourceful teacher who knew how to navigate the system and seek out the opportunities the school had to offer. When I asked how she was able to access such resources, she informed me:

> I inherited materials from other coworkers that I worked with that have been helpful. (Sade INT – April 26, 2011).

Probing with a follow-up question, I asked how she heard about the resources available to her. She continued:

> Through word-of-mouth and talking to other teachers and administrators about it, conferences as well. I think this year we've been – our school's really made a big effort to work – to have time, collaborative time built in. I think because it is such a small school that when we – there's only two sections of third grade or whatever it is, it's been easier to inherit those things through, because it's a small school. We have common planning time too. (Sade INT – April 26, 2011).

When I asked her to describe the most crucial resources needed to differentiate instruction to students with mixed-ability in a self-contained classroom, Sade summarized these resources as capacity and time as follows:

> It (differentiating instruction) requires more time, a lot more planning, a lot more resources and a lot more organization. I think that teachers here want more help with differentiation. I know that it's the buzzword that we are always talking about. It's great. It's one thing to talk about it or read about it, but to see and actually be trained in it. For example, here are your students, do you have what you need, or this what you do, take these materials and actually help set up a classroom? (Sade INT – April 26, 2011).

At one point during the interview, I explored the issue of time constraints. I wondered if it was unrealistic to ask a teacher to differentiate instruction during the school day without the necessary time to plan even with the resources available to teachers at North Court. Sade expressed her viewpoint:

> Well, I think when it's done correctly, it can be easy. But even with small classes, I mean it's sitting down and every single lesson throughout the day to differentiate is challenging. It is unrealistic. In that conference, I thought I could add an additional differentiated lesson each week. (Sade INT – April 26, 2011).

Sade's response indicated that she regarded the scenario of differentiating each lesson every day as unrealistic. As stated, time was a tremendous obstacle for high levels of implementation of differentiated instruction in mathematics even for such a highly committed teacher.

I had heard through my informal conversations with the principal that leadership also provided opportunities for teachers to access a mathematics coach to help them differentiate instruction. While the school provided this support on an as-needed basis for the current school year, Sade did not take advantage of this resource. Her main reason was that working with a coach while useful was too much of a drain on her time.

> I don't know if I'd really want a coach just because of how much we're expected to do, and all the workload that we have on a weekly basis. It might be overwhelming. But I would be definitely interested in professional development in the faculty meetings, if that would happen. That would be awesome, and I'd be interested in summer as well. (Sade INT – April 26, 2011).

During our interview, Sade expressed that weekly faculty meetings were spent too often reviewing information and not tailored to provide specific training on mathematics or differentiated instruction. Subsequently, she believed professional training as a resource for teachers could be more strategically implemented during the school year. Sade described her vision for training to me:

> I would like someone not only from the publisher to come in, someone who knows how to differentiate, is really experienced with all the different curriculum for all different grades levels and come in and say…this is your program. With this program, here's what we recommend. (Sade INT – April 26, 2011).

Based on her comments, Sade was acutely aware of the challenges of implementing differentiated lessons daily. Nevertheless, she demonstrated a willingness to continue to improve her practice by looking for ways to enhance her craft because she believed it is an educator's own responsibility to do so (Sade INT – April 26, 2011). When I explored what good professional development in her eyes might look like, Sade envisioned using faculty meeting time for training, although this scenario did not reflect the resources unavailable to her:

> I think we (teachers) are always searching for time here, to get together with staff to discuss whatever it is, scheduling issues or just issues that are on campus. I see embedded professional development during faculty meetings as a wonderful opportunity, and I would definitely be interested in it. But I can see it being like ten faculty meetings, and then, that means it's going to take away from other time we need to deal with current issues or different things. But, I think that it would be an amazing opportunity (Sade INT - April 26, 2011).

Sade was eager to support her colleagues and looked for ways to share access to resources and training with other faculty. For example, Sade was one of eight teacher leaders within her

organization who continued to seek professional development in the area of differentiated instruction and attended a recent conference. Sade commented:

> I recently got back from a conference, and it was all about differentiating, but it was across the board. It was the ACSD conference taught by Tomlinson. There was a team of us…probably eight of us. I'm on this committee at school called PAWS, it's like a leadership team. I used some of things that I gathered from the conference in my own classroom, but as far as the whole school, I think that's where it's headed…we'll kind of be these leaders for the school (Sade INT - April 26, 2011).

As I continued my second interview, I was interested in finding out about Sade's relationship with her school principal and whether or not she thought the principal facilitated trainings for mathematics or differentiated instruction. I also asked her if the principal or other administrators attended the recent workshop on differentiation and what were the principal's expectations, if any, for the teachers. Sade replied:

> Yes, just the principal attended (the conference). We talked about it (the conference) briefly at our faculty meeting when we got back, and then we were going to get together as a team, at our next meeting and share some more information. I don't know what the long-term goals are. (Sade INT –April 26, 2011).

When I probed more deeply about her relationship with the principal, Sade did not offer any supplementary impressions. Her comments about the principal were neither positive nor negative. She was diplomatically neutral and redirected her remarks about the principal to a focus on the organization trying to grasp an understanding of the long-term goals and how RTI fit in. When I asked again about organizational leadership and expectation to increase the practice of differentiated instruction in mathematics through RTI, she replied:

> I think there's a concentration right now, this year, on math. But I recently got back from the conference and it was all about differentiating and it was across the board. But, I'm not sure. (Sade INT – April 26, 2011).

Sade seemed unclear about the principal's own unclear agenda with differentiation and therefore continued her own work by doing what she believed was best for her students in the area of mathematics.

Summary of the personal factors and organizational conditions for the high implementer

The data from formal and informal interviews and my classroom observations showed a strong relationship among observable teaching behaviors, personal experiences, and beliefs about students that may contribute to a high degree of implementation of differentiated instruction. Throughout the study, Sade exhibited the behaviors and practices of a teacher of high quality. Sade was a highly qualified teacher who had a good reputation with parents, students and her

colleagues. She had exemplary classroom and behavior management skills and was able to differentiate instruction by content, process, and product, as evidenced during my observations of her inclusive teaching environment. She carefully managed routines by providing explicit directions so students were engaged and comfortable in the learning environment.

I was impressed by Sade's passion and commitment to her students. She exhibited strong teaching skills that the literature associates with implementation of ambitious instructional design, and she understood that teaching mathematics was more complex and developmental than other subjects. She clearly expressed to me that her students required more individualized attention to grasp the cognitive complexity for learning mathematics. She was highly concerned about the effective use of time needed to differentiate instruction on a daily basis. She also did not see the possibility of implementing this practice across other subjects as well given the constraints of daily work place demands already put upon her. Even though she accepted the challenge of individualizing instruction as a strategy to meet the needs of her students, she used the adopted mathematics curriculum for differentiation and enrichment when available and appropriate.

Furthermore, Sade demonstrated a willingness to work hard and grow professionally. Even though Sade identified time and capacity as constraints, she exerted extra effort in attending workshops after school hours to improve her craft. Sade commented that she appreciated the opportunity to attend the workshop on differentiated instruction. She also balanced her daily workload with the resources and opportunities available to her. For example, Sade ignored messages from the principal or did not take advantage of resources that did not fit into her own vision of what was right; she refused the services of a coach because of the time and energy needed to pursue this resource.

Sade also expressed confusion about the school's long-term goals and the connection between differentiated instruction and RTI. I was struck by Sade's genuine interest in finding ways to not only support her students but her colleagues. Sade viewed herself as a lifelong learner committed to meeting the needs of her students through the practice of differentiated instruction and professional growth. She also believed her colleagues were responsible for continuing their learning. While Sade acknowledged the challenges of implementing differentiated lessons in mathematics, she was also realistic. Her desire to continue learning and do what was needed for students made her unique. She was a teacher of quality who possessed a strong willingness to persevere in the presence of constraints.

In sum, Sade had the commitment, skill, and ability to take advantage of resources in a resource-rich environment. Even this very committed and skillful teacher, however, saw severe constraints in implementing differentiated instruction on a regular basis and was unable to take advantage of the support available to her because of her personal time economy. Therefore, this case study sets the outer limits of what seems possible. Sade presents a sobering view of what must be considered an essential goal for implementing differentiated instruction in mathematics. In my analysis of Sade, I learned differentiated instruction is not a prescriptive program that can be bought off-the-shelf or mandated by leadership. This complex instructional practice cannot be easily implemented without significant change in the following areas: a reorganization of time demands put upon teachers during the ordinary work day; a different way of facilitating professional development in both differentiated instruction and mathematics; and an investment from both policy and educational leaders on how to implement and develop a program that supports differentiated instruction.

Case #2 – The Low Implementer

Nina was one of five participants from North Court School who volunteered to participate in my study. Of the nine selected cases, Nina was the only teacher classified as a low implementer. She was chosen for this in-depth analysis because she had characteristics and organizational context similar to Sade's, the high implementer. These shared characteristics (depicted in Figures 5 and 6) were type of school (e.g. high wealth); years of teaching experience; similar class size; and no formal training in differentiated instruction. In my analysis of Nina, I begin by highlighting her professional and educational experiences and my observations of her teaching using similar generic terms for high quality teaching as I used to describe Sade. Then I describe the teaching practices I observed while visiting Nina's classroom as she taught a mathematics lesson. Next, I describe personal factors: Nina's beliefs, attitudes, and experiences. I follow up with Nina's perceptions about the organization and leadership.

Observed behaviors and differentiated instructional practices in mathematics for the low implementer

At the time of this study, Nina, a sixth grade teacher, had been teaching for over four years. She began her teaching career as a middle school mathematics teacher at North Court School after earning her single subject credential[22] in mathematics. She was highly qualified by NCLB standards and was authorized to teach specific subject mathematics courses in any of the following areas: algebra, general mathematics, geometry, probability and statistics to students in grades K-12. While Nina possessed the proper credentials to teach mathematics and enjoyed teaching, she lacked other attributes found in high quality teachers selected for this study (depicted in Figure 8). By way of interviews and observations I found that Nina, compared to Sade, lacked command of the generic practices the literature posits as preconditions for implementation of complex instructional designs, such as differentiated instruction. She also was less skillful in managing a classroom generally and especially in addressing students with diverse needs (depicted in Figure 11).

Under the new principal, Nina was assigned to teach sixth grade after having spent her previous years at North Court teaching seventh and eighth grade mathematics. She had twenty-two students in her sixth grade mathematics class that I observed (Nina OBV – March 3, 2011). I heard through my informal conversations with the principal that Nina was well liked by her students, parents, and colleagues but still had much to learn. Nina was very eager to participate in this study as a means to improve her own practice, and I was grateful she volunteered to assist me.

During the observation of Nina's teaching, Nina used humor to engage her students and create a welcoming environment (Nina OBV – March 3, 2011). She not only greeted her students with funny gestures and facial expressions at the door when they arrived, but she also dressed up to the get the attention of her students. During this observation, I saw Nina receive laughs from her students when she dressed in a pink kindergarten vest that was clearly too small for her.

[22] Secondary (Single Subject) Teaching Credentials authorize the holder to teach the specific subject(s) named on the credential in departmentalized classes such as those in most middle schools and high schools. However, a teacher authorized for single subject instruction may also be assigned to teach any subject in his or her authorized field at any grade level-- preschool, grades K-12, or in classes organized primarily for adults. Source: Commission on Teacher Credentialing. Retrieved January 2, 2011, from http://www.ctc.ca.gov/credentials/CREDS/secondary-eachintg.html

Figure 11 – Evidence of Nina's observed behaviors and differentiated instructional practices for low implementation

A. Expectations for students	***Evidence observed during classroom observation***
1. Connects students' prior knowledge, interests and life experiences with learning goals of the lesson	Nina began her lesson with a warm-up activity and asked students to uncover the answer individually or cooperatively.
2. Uses a variety of instructional strategies and resources to respond to diverse needs	**No evidence was observed during classroom observation.**
3. Articulates short-term and long-term goals for individual and group work	**No evidence was observed during classroom observation.**
4. Facilitates learning experiences that promote choice	**No evidence was observed during classroom observation.**
5. Promotes self-directed, reflective learning for all	Nina walked around the room to check for understanding.
6. Commits to providing equitable learning experiences	**No evidence was observed during classroom observation.**
B. Teacher's norms for student behavior	***Evidence observed during classroom observation***
7. Establishes a climate that promotes fairness and respect with a focus on teaching/learning of mathematics	Nina demonstrated high regard for her students by asking questions and providing praise.
8. Answers questions when needed and uses time efficiently	Nina consistently walked around the room to check-in with her students.
9. Creates a physical environment that engages all students	The students appeared ready to learn in a very calm, safe environment.
10. Establishes and maintains standards for student behavior that support student learning	Nina had a reward system, as a classroom management strategy, in place for each table group that responded in a positive manner to her directions.
C. Skills and expertise in differentiating instruction in mathematics	***Evidence observed during classroom observation***
11. Demonstrates knowledge of subject matter content and student development	While Nina demonstrated knowledge of the subject matter, there was no evidence of differentiation in this area for students.
12. Establishes routines for beginning and ending class; changing workstations; sets parameters of workspace and time; and collecting/returning student work	**No evidence was observed during classroom observation.**
13. Organizes curriculum to support student understanding of the subject matter	The lesson was taught predominately in lecture style and not structured to support individualized student understanding.
14. Provides clears directions for auditory, visual and kinesthetic learners (e.g. utilizes task cards, charts, white boards, peer helper, etc.)	Nina provided clear directions for the warm-up problem solving activity asking students to work independently or in a small group.
15. Uses materials and resources to make subject matter accessible to students	Nina used and interactive white board to teach in a very traditional manner.

On my second visit to Nina's classroom, I observed a similar greeting; Nina welcomed the students with a warm smile as they entered her classroom and asked them questions about the homework (Nina OBV – April 26, 2011). During both observations, Nina's sense of humor was clearly communicated and well received by her students. Nina made a concerted effort to connect personally with each student through her carefree and friendly demeanor. Though she strived to personalize the learning environment for her students, she was troubled with heterogeneity. When I asked Nina to describe her students and their abilities, she responded:

> It is really a challenge because I have quite a few students who are resource (special education) students and some kids who are not, then some kids that are just really weak in math skills, and then some that are okay all sitting in one class. I find it a tremendous challenge to not bore the kids who get it and not frustrate the kids who have no idea what's going on and then have to get through the curriculum in the course of the year. (Nina INT – March 3, 2011).

Nina's response revealed her concerned and worried disposition about too much heterogeneity in her classroom. While Nina expressed interest during our interviews in wanting to implement differentiated instruction as a strategy to meet the needs of her students, she was reluctant to embrace the learning differences in her classroom.

Nina delivered mathematics instruction in a fairly consistent format. The length of her lesson was approximately 45 minutes. Classroom desks were arranged in groups of six to allow for peer-to-peer interactions. Four of the desks faced each other with the other two desks facing the front of the room and white board. The arrangement of desks created an environment where students were allowed to talk to their peers throughout the lesson and provided opportunities for student engagement. I also noticed the contents of a hand-written poster mounted in the front of the classroom that listed Nina's daily expectations as displayed in Figure 12.

Figure 12 – Poster in Nina's classroom: What do I do now?

1	Carefully check your homework.
2	Thoroughly rework problems that you missed.
3	Practice types of problems you feel you need to work on.
4	Assist others in their understanding.
5	Do warm-up problems.
6	Do the problem of the month.
7	Work on problems in your textbook.
8	You should be quiet, focused, working and not distract others.
9	You may speak quietly only when you are assisting others.

The poster was Nina's way of managing her classroom by explicitly posting the instructions on the wall. This poster is significant because she began her lesson reminding her students of her expectations, pointing to the poster as she walked around the room. During my observation, it appeared that she used the poster as a reminder to keep students engaged. She began her lesson by asking students to check answers to the homework followed by a warm-up activity. She stated:

> Good afternoon, come in and begin checking your homework. Homework answers are on the board. Once you're done working on the problem on the board…tell me what is the area of this figure? (Nina OBV – March 3, 2011)

Nina walked around the room with her grade book marking whether or not a student completed his/her homework as students reviewed the homework and worked on tasks either cooperatively or independently. The noise level was moderate with most students engaged in dialogue with a

peer or addressing Nina. Nina answered questions and attempted to check in with each student, but often was interrupted by students who walked up to her to ask questions.

While students were working and talking, Nina walked over to me to explain her strategy. She told me students were encouraged to work with their peers to solve problems. Students were also allowed to move around the room and find someone in the class with whom they could work. When I asked Nina to describe her thoughts about how she grouped the students, she interpreted this as a question about tracking and not differentiating instruction:

> Tracking works well for Algebra. It has really helped to have them tracked, really helped because if I have a student in a class that just doesn't understand how to multiply two fractions and then the other students are just conceptually very advanced, it is really just frustrating for them. The only thing is just the social, emotional aspect that I worry about. When the kids get into the lower class, you can see them act out, they realize where they are and so that's kind of a blow I think to their self-esteem, understandingly so. So it affects their desire, you know. They've been told pretty much that they're not good at math. (Nina INT – March 3, 2011).

Nina appeared both confused in conflating tracking with differentiation, and frustrated, as expressed in her concern for the social well-being of her students.

During my observations, I noticed Nina's teaching practices related to classroom time management and discipline. I asked myself whether or not she understood the importance of using time efficiently in her classroom to gauge the individual needs of her students – an important skill needed to differentiate instruction as stated in the literature. When I asked Nina to describe how she knew her students were learning and ready to move on, she said:

> So circulating the room, listening to their comments and the questions they ask or, of course, there are those who disappear so I have to pay extra attention when a student isn't asking questions, so it doesn't mean that they get it – that they're so lost that they're afraid to ask or don't know what to ask. (Nina INT – March 3, 2011)

She could not clearly articulate how to individualize instruction. Even though she had expressed that she preferred tracking as a structure for eighth grade students, she stated her concern for her sixth grade students in the following way:

> I don't think it's (tracking) a very good model for the sixth graders. For the eighth grades, for algebra, I think the structure is very helpful because algebra is so complex; they're more mature so they can take notes. I am struggling with it. (Nina INT – March 3, 2011).

Time management was a problem. During the lesson observation, approximately thirty minutes had passed before the lesson of the day was delivered (Nina OBV – March 3, 2011). Nina had lost track of time or made the decision that students required more time to solve the problem as she attempted to informally assess student learning. Several times throughout the lesson, Nina needed to remind her students to stay on task. She prompted her students, "Looking

for your attention here, looking for your attention here" and assigned table points as a classroom management strategy to the first table group that responded and got back to work (Nina OBV – March 3, 2011). Nina also often ignored inappropriate student behaviors. I witnessed Nina willing to let some disruptive behavior among students escalate as she continued to walk around the classroom checking in with each student.

While Nina expressed high regard and care for her students, her management style and teaching approach did not incorporate the use of varied instructional strategies to respond to the diverse needs of her sixth grade students. Figure 8 provides evidence of the behaviors that were observed and areas that were not addressed during her lesson (Nina OBV – March 3, 2011). Nina, instead, delivered instruction in a very conventional manner as compared to Sade. Even though Nina engaged her students by allowing group work and encouraged them to talk to their peers, she did not incorporate differentiated instructional strategies to engage all types of learners. On one hand she wanted heterogeneity in sixth grade, but on the other hand, she left most of the task of teaching a cognitively challenging mathematics assignment up to the students to learn as she walked around the room to check for understanding. When I asked Nina how she differentiated instruction, she said:

> I did a pre-test once and then from that – within the classroom I gave two different groups of students different sort of things to focus on depending on what they were ready for and then I had to figure out a way to bring them all back together and again by the end of the chapter. So it took more coordination and so it seemed useful. It required a lot more time. (Nina INT – March 3, 2011).

Nina's comment that she had only "once" incorporated a pre-test as an assessment strategy for differentiating instruction confirmed my observations that she did not often include many of the strategies used to individualize instruction. For example, I did not see evidence of her utilizing additional materials or resources to supplement learning or an environment structured to promote individualized learning experiences during my observations.

Personal factors: beliefs, attitudes and experiences of the low implementer

I first met Nina in January prior to the onset of this study when I spoke to the faculty at North Court School and invited nominees to volunteer for my study. When we sat down to talk informally about her interests, Nina shared her passion for teaching mathematics, hoping to make a difference in the lives of her students. My impression of her was that she was sincere and eager to improve her practice and looked forward to engaging in conversation with me over the course of the study.

After the screening process, I met with Nina several times over a period of four months. I informally and formally observed her teaching and conducted two formal interviews. I also engaged in casual dialogue over the course of the study when I visited the site. I would encounter Nina in the hallways or teachers' lounge as I waited to interview or observe other participants selected for this study.

During my first formal interview, I wanted to know more about her experiences and beliefs and perspectives about teaching students with diverse needs. Nina appeared to be a generally positive-minded individual who spoke highly of her students and believed in their

success. But she also appeared unsure of her own ability to help her students achieve, and was very candid about the fact that meeting the individual needs of her students was a challenge. Her explanation was easily discerned:

> It's really a challenge for me because I have quite a few resource students and some kids who are not. There are some kids who are 504[23] kids and then some kids that are just really weak in their math skills, and then some that are okay, all sitting in one class. And so I find it to be a tremendous challenge not to bore the kids who get it and not frustrate the kids who have no idea what's going on and get through all the curriculum in the course of a year. (Nina INT – March 3, 2011).

Throughout my study, it became more and more evident that Nina felt deeply responsible for her students' learning but lacked the confidence in her own abilities to make a difference.

Given Nina's desire to do what was best for her students, I was intrigued to know more about Nina's training in differentiating instruction. During my second interview, Nina shared her experiences:

> See now I don't think I have had any training in differentiation. I have a book on it, which I have. I've read a couple of pages. I've heard theoretically different people's opinions on what differentiation is and what I found interesting is I've heard a couple of different definitions. One is that you try to create a curriculum that's unique to each student which I don't think that's the most accurate definition but I've heard that used or another is that you create a curriculum or lesson that allows all different kinds of learners access to that lesson. So it's rich enough so that every student has a way in. (Nina INT – March 3, 2011).

On one hand, she was familiar with some theories on differentiation, but on the other hand, she herself felt uncertain about her expertise in the area. To my question during the second interview about the unique features of mathematics as a subject matter for a mixed ability classroom, Nina replied:

> I would imagine it might be similar. I guess my take is if a student doesn't have basic number sense, when other students are fine and solid, that disparity just makes it tough. It's a challenge for me to figure out how to present all the materials, so they all have access to it because there's just so many gaps – abilities in one class. (Nina INT – April 26, 2011)

[23] The "504" in "504 plan" refers to Section 504 of the Rehabilitation Act and the Americans with Disabilities Act, which specifies that no one with a disability can be excluded from participating in federally funded programs or activities, including elementary, secondary or postsecondary schooling. A 504 plan spells out the modifications and accommodations that will be needed for these students to have an opportunity to perform at the same level as their peers.
Source: About.Com. Retrieved February 25, 2012, http://specialchildren.about.com/od/504s/f/504faq1.htm

Nina's mathematics specialization did not translate into her sense of being prepared to meet the daily changes of teaching mathematics to a diverse group of students. In general, she did not give much credit to her training:

> I received my education from the State University. It was a two-year program I believe. My gosh, I don't entirely remember. It was kind of a blur. I believe it was two years and within the program (teaching credentialing program), I took some math courses. I probably took four to six math classes. I also don't think I have any training in differentiation. (Nina INT – March 3, 2011).

She continued:

> There were aspects of the program that were helpful. I guess the short answer is it didn't entirely prepare me for teaching math. I would have loved to be teaching while I was learning but I guess you can't really do that because you kind of need some insight when you have never been in a classroom. (Nina INT – March 3, 2011).

Despite Nina's more in-depth single subject preparation in mathematics, she recognized that she was indeed insufficiently prepared to meet the complexities of instructional formats, such as differentiated instruction. Yet, as I looked back, I wondered how Nina's love of teaching mathematics and belief in her students played out in her hopes and dreams for her students. When I asked about her expectations for her students, she said:

> I would love for them to be tenacious I guess. But if you ask me again tomorrow I might say something different. But to be tenacious, kids generally speaking, seem to give up a little too soon. So I would love to help engender that. (Nina INT – March 3, 2011).

I could see that Nina had high expectations for her students and expressed genuine interest in their learning. She had the qualities of a good teacher who nurtured an emotionally safe environment by using a variety of strategies, such as humor, to engage her students. She also possessed something that we all appreciate in others, that is, a willingness to admit mistakes and challenges. Even though Nina lacked confidence in her own skills, it was evident from my interviews and observations that she desired to fine-tune what she already knew to help her students succeed.

Organizational conditions: low implementer's perceptions about the organization, resources, and organizational leadership

As part of this study, I observed Nina teaching her sixth grade class. During her tenure at North Court, Nina had been previously assigned to teach sections of seventh and eighth grade mathematics until this past year when she was asked by the principal to teach two sections of sixth grade, two sections of seventh grade, and two sections of eighth grade – a total of six

classes. Her assignment included teaching two different levels of sixth grade mathematics and two different levels of eighth grade algebra. All in all, her workload demand included preparing for five different levels of mathematics. She was given only one period a day to prepare her lessons and meet with other colleagues who were available. Nina was also assigned an additional responsibility during her lunch period once a week that included coaching Math League[24].

Nina was confused by the district goal of differentiated instruction for mathematics and the contrary use of RTI as a means to create tracked classrooms. Her frustration was palpable:

> I just came back from the summer and things were changed from last year. This decision came from administration. So many changes happened this year. I don't know what next year is going to look like or what they're going to focus on. While students seem tracked and it's such a small school, since the algebra class is small, I have an advanced geometry student who joins the low algebra students. (Nina INT – April 26, 2011)

As previously stated, the principal's message was that teachers would be more successful individualizing instruction by limiting the amount of heterogeneity in each classroom. Due to scheduling challenges in a small school, forming more homogeneous learning groups was not practical. Students were in fact grouped heterogeneously contrary to the stated intention of the administration. When I asked Nina to tell me about the principal or leadership's philosophy about teaching mathematics, she responded:

> Well, as far as the leadership's values and beliefs about mathematics, I am a little confused as far as what their values and beliefs are. They talk about differentiation. But everything they've been doing has been tracking and the whole schedule has been driven by math placement. That's caused a bit of an uproar, a lot of frustration for all. (Nina INT – April 26, 2011)

Nina considered the stance of leadership as one of basic lack of understanding of how to teach mathematics and lack of support for teachers. Nina discerned what was acceptable by the administration:

> So I don't know if there's exactly development of mathematics or just a direction being taken and you need to just hop on. You need to be part of that, where it's headed sort of thing. Just so many changes happened this year. I don't know what next year is going to look like or what they're going to focus on, or how people are going to feel about the number of

[24] Math League's 6th, 7th, and 8th grade contests challenge students and schools in interschool league mathematics competitions. Students in each league compete for the highest scores, while schools compete for the highest team score: the total of the top 5 scores in each school. Each contest's questions cover material appropriate to each grade level. These contests encourage a variety of problem-solving skills and methods, to improve students' abilities and understanding of mathematical connections, while allowing them to have fun. Source: California Math League. Retrieved January 2, 2011, from http://www.mathleague.com/contests.htm#BM6th_8th

different classes. (Nina INT – April 26, 2011).

In sum, Nina's frustration appeared to be the product of a demanding workload, constant changes within the organization, feeling misdirected by leadership (specifically the principal) as well as her own lack of skills in implementing complex instructional practices.

Nina had the benefit of working with a mathematics coach over her years at North Court. Even though the coach was available to her during the time of this study, she did not take advantage of this resource for several reasons. First, she was confused by all the mixed messages she was receiving from the administration and the demands put upon her. Second, it appeared that Nina did not regard interactions with the coach as helpful as she continued to struggle with what a classroom looked like where differentiated instruction was implemented. Her perceptions about the mathematics coach are captured in these comments:

> I'm sure she's a fabulous coach. But I needed structure. I needed to know, okay, what can my class look like? What do I need to do – I needed to tighten things up, because I'm already teaching direct instruction – I can do that okay. What I really needed was structure. How can you keep track of what it is that (the students) they're learning? How do you take notes? I really needed structural stuff, and I am not sure she helped with that. (Nina INT – April 26, 2011).

When I asked Nina specifically why she chose not to continue to work with the coach, she commented:

> No, because I would like more perspectives now. I think she's been helpful. I think there are some things I agree with, some things I don't. She thinks that projects are a waste of time. So there are things that I just diverge from her. (Nina INT – April 26, 2011).

From these interviews, it appeared that the relationship between Nina and the coach deteriorated because of a disconnect between the advice she was receiving and what Nina herself believed she needed to meet the needs of her students. Nina was not able to clearly articulate any benefit from the coach. The coach, Nina reported, asked her to implement a direct instruction model to help her tighten up classroom management. Nina acknowledged that she needed more structure. But then again, she wanted to be able to handle more complexity and for that, the coach's direction was not helpful. From my observations, Nina needed both - more clear structure and more complexity; she was not sure how she could make improvements in both dimensions. Rather than drawing from what the coach could offer, she elected to withdraw.

As a follow up, I wanted to know what resources would be most valuable to her to differentiate instruction. She stressed the need to observe a good model:

> So to deepen my knowledge of math, for me, and I don't know if this is possible, but if a teacher was fabulous at differentiating math, I'd love to sit in their classroom. I want to see it. The professional development, talking about it, yeah, that's helpful. Getting resources, talking about it, but I really want to see it happening. (Nina INT – April 26, 2011).

Nina had her own ideas about what supports should be put into place for her and her colleagues. However, she told me that she did not express her ideas to the administration (Nina INT – April 26, 2011). When I asked her what she would ideally like to see changed in the organization in order to differentiate instruction, she summed up:

> I would love to be able to focus on teaching one grade and then I would love to be able to collaborate with other teachers. Ideally it would be nice to have maybe occasionally a longer period not necessarily every day but at least occasionally because having only 40 minutes or so, it not enough time – they are just getting into it when it's over. (Nina INT – March 3, 2011).

Nina wished she had more instructional time to work with students. Additionally, Nina deplored the lack of structures within the organization to support mathematics. For example, she commented that the school did not have a math department or math committee to evaluate program changes and best practices. Even though Nina was given one period a day to plan with her fellow colleagues, she did not see that time as an opportunity to work with her colleagues. As expected, it appeared that her common planning time was used solely to prepare for her classes and additional duties. She reminisced about one occasion that she found helpful:

> We did get together to talk about math K-8. We did that once but there was no committee per se. We had never done that before in the years since I have been here. This year we have been given time to meet as a math department during a staff meeting, that's been good. That was a good conversation – 5th through 8th grades. (Nina INT – April 26, 2011)

Nina's statement that the math department met once during a faculty meeting did not translate to enough time for her to learn how to implement differentiated instruction:

> I would like to add more to the pool of being more than just a faculty. I would like to talk to somebody who teaches eighth grade, somebody who teaches sixth grade. The conversations I have had over the past four years have been very small – I need to get out more, but it's hard to. Plus teaching two levels of sixth grade math, and two levels of algebra, it is just a lot to plan for. (Nina INT – April 26, 2011).

Time was a big issue for Nina. She repeatedly stated that she needed additional time to teach math and time to learn from other teachers teaching similar classrooms. But she also acknowledged that her time was severely curtailed due to her own private life:

> It's a combination of a few things, especially now that I have my own children, so time has changed. (Nina INT – April 26, 2011)

Summary of the personal factors and organizational conditions for the low implementer

The data from interviews and my classroom observations revealed several factors and conditions that contributed to Nina's low implementation of differentiated instruction. First, Nina had good intentions, but did not follow through. Nina often conveyed time as a constraint both during and after school in her private life. She was teaching sixth grade for the first time. Her workload demands included having to plan for five different sections (e.g. 6^{th}, 8^{th} and Mathletes) and she implied several times that structural conditions within the organization needed to change in order to implement differentiated instruction.

Nina often expressed high regard for her students but lacked structure and classroom management skills necessary to manage complex instructional formats to tackle heterogeneity. She herself did not think that her mathematics credentials and teaching experiences prepared her for the challenges of working with students with mixed abilities. She tried to teach in a student-centered way, but often fell short in her teaching. She grappled with finding a balance between teaching in a more traditional way and trying to meet the needs of all her students. While Nina appeared to grasp some theories on differentiation, she did not fully understand how to structure a lesson to vary the activities by abilities within her classroom.

Nina's confusion about mathematics and differentiated instruction were compounded by the mixed messages she received from the administration and the reality of the master schedule. On one hand, she was asked to embrace differentiation, but on the other hand, RTI diagnostics were to be used to homogenize learning groups, which in reality could not be accomplished due to the size of the school. Confusion deterred Nina from taking advantage of the resources that were available to her.

All in all, Nina was friendly, supportive and committed to meeting the needs of her students. However, she lacked classroom management skills and had difficulty managing the complexity of diverse learners. Nina also saw that severe time constraints and the organizational structure of her workload demands taxed her ability to implement differentiated instruction. Nina's case may express the limits on what can be expected from a willing teacher whose time, energy and skill are in average or short supply.

Comparison of the High Implementer and the Low Implementer

By looking more deeply into classroom practices and interviewing each of the participants, I aimed to unravel personal factors and organizational conditions that accounted for the contrasting levels of implementation quality for differentiated instruction in each exceptional case. In this section, I compare the two contrasting cases. Figure 13 provides a summary of each case and describes the broad factors and conditions for analysis and synthesis. A description of the coding for analysis found in Appendix L and recorded as either a plus (+), minus (-), or mixed/neutral (+) rating depict responses to interview questions or patterns of observed behaviors of each case.

Figure 13 – Findings of the personal factors and organizational conditions of the high implementer and the low implementer

Key: **+ Strong presence** **- Weak presence** **± Neutral response**		**Sade**	**Nina**
Personal Factors (P):			
P_1	Willingness to forge ahead and overcome obstacles	P_1+	P_1-
P_2	Willingness to grow professionally after work hours	P_2+	P_2-
P_3	Competency with subject matter and implementing complex strategies	P_3+	P_3-
P_4	Classroom management skills	P_4+	P_4-
P_5	Prior experience teaching same grade level	P_5+	P_5-
Organizational Conditions (O)			
O_1	Alignment with organizational structures within the work day	O_1±	O_1-
O_2	Alignment with principal's vision for meeting the individual needs of students	O_2±	O_2-
O_3	Utilization of available resources and materials	O_3+	O_3-
O_4	Participation in professional growth opportunities	O_4+	O_4-
O_5	Utilization of available support from math coach	O_5-	O_5±

I proceed by examining how each dimension appeared across the two exceptional cases. There are some key dimensions in which the high and low implementer differ:

- Attitudes, certainty and a strong determination to close the gulf between vision and reality in one's classroom;
- Teaching skills, ability to handle the management of complex instructional formats;
- Organizational conditions such as time, resources, materials, school vision, and principal's leadership.

In terms of philosophies and psychological dispositions, both Sade and Nina cared about their students and had a reputation of being well-liked by students, parents and colleagues. With that said, Sade had a willingness to forge ahead and overcome obstacles, while Nina seemed less sure about her practice and wavering in perseverance. For example, Sade had a 'can-do' attitude and approached her teaching responsibilities with confidence and rigor as evidenced by her remarks during our interviews.

Sade was proactive about learning and willing to seek professional training after work hours while the opposite was found for Nina. For instance, the data showed Sade had taken advantage of the many opportunities afforded to her such as attending a conference on differentiated instruction. Nina did not have the time or energy to attend conferences because of the constraints of her private life. As a result, Nina did not exhibit the same proactive stance or willingness to grow professionally after hours as her colleague, Sade.

As for teaching skills and ability to handle the management of complex instructional format, I found that Sade possessed greater skill in managing her classroom, and had prior experience teaching the same grade level as compared to Nina. The fact that Sade had previously

taught the same grade level for four years provided her with more routines, experiences, and skill with teaching mathematics to her third grade students. Sade embraced heterogeneity through differentiated instruction and took pride in the fact that her students were learning. Meanwhile, Nina taught mathematics in a traditional manner and had difficulty managing a diverse group of students and implementing complex instructional strategies. She was committed to her students but lacked the routine experiences afforded to Sade to fully grasp how to teach a diverse group of students.

Being that the high and low implementers taught at the same school, both participants were exposed to similar contextualized characteristics. Class size was similar with approximately 21 and 22 students, respectively, of mixed abilities. Both were exposed to the same mixed message of individualizing instruction through differentiation, but also of using RTI diagnostics to create tracked learning groups. It was conspicuous that Sade simply ignored mixed messages from school leaders, while Nina strongly engaged with these mixed messages and allowed them to feed her confusions further. Neither one of the two teachers made use of the mathematics coach, one out of feeling a superior competence and the other out of inability to discern how she could productively use this needed resource.

In sum, it was not that the two teachers differed in their conviction that differentiated instruction was appropriate and a good thing, and it was not that one was more caring or more supportive of her students than the other. Indeed, both teachers could be considered committed and caring teachers. But what stood out for Sade was that she was sure of herself. She had clear goals and she worked hard at meeting them. Over the years, she had developed a personal teaching style that came close to her vision. This vision included the ability to manage complex instructional formats and to individualize and differentiate instruction to the degree possible. Her vision of teaching mathematics was that it was cognitively and developmentally challenging, and therefore students needed more time in the day to grasp the material. Her personal surety helped her exploit the resources that fit her ideas and made her distant to those that did not. But even this teacher, with all her teaching expertise, determination, commitment and ability to selectively exploit organizational resources available to her reneged on differentiated instruction as a regular feature in her classroom. Even for this most skillful and committed teacher, widespread implementation of differentiated instruction seemed counterintuitive given the tight time constraints and daily demands on her time and energy.

Compared to Sade, Nina was far less certain of her teaching ability and indeed had many more challenges in handling any kind of complex instruction in her classroom as her struggle with classroom management revealed. Though this teacher was aware of the gulf between her vision and her reality, it did not compel her to act strongly. In all likelihood this hesitancy to act was perhaps not only related to the task of implementing differentiated instruction. Nina's vision of this strategy, to begin with, was unclear. She did not have the understanding of when it was appropriate and when it was not. She did not know what exactly she needed to change. Unlike Sade, she could not benefit from available resources, such as the services of a coach. All these combined were a source of frustration for her and she could not articulate what she did not know. Her confusion was abetted by a principal whose actions regarding differentiated instruction betrayed to her a divergence between stated principals and actual practices. Her uncertainty fed off this contradiction.

We saw in Sade's case how severely restricted the high implementer assessed her time and energy for implementing high quality differentiated instruction. No amount of professional development or resources, and no amount of personal commitment could compensate for it. With

Nina, I encountered a teacher whose resources were much more constrained due to her personal life demands but also due to the newness of her teaching assignments and the multiple duties she had to cope with. Not unlike her colleague, Sade could see nothing in her collegial environment that seemed to attenuate these constraints. Collegial interactions at North Court seemed all to amount to rare conversations, generating little relief from the time constraints by way of dividing up tasks collaboratively. Taking the two teachers together, Sade, the high implementer, wanted to see programs that worked out the differentiated curriculum for her while Nina, the low implementer, wanted to see models with high quality implementation.

Fitting the Contrasting Cases into the Continuum of Cases

In this section, I analyze the seven additional cases exhibiting varied implementation quality of differentiated instruction and try to match them with patterns distilled from the contrasting cases analysis. I go beyond the scope of merely two extreme cases and corroborate factors as I look through the spectrum of a continuum. I ask whether explanatory personal factors and organizational conditions that revealed themselves in the contrasting cases would still hold up for cases with varied implementation quality of differentiated instruction. At a certain point during the analysis (depicted Figure 14), data from the participants about personal factors and organizational conditions began to repeat themselves and no new patterns emerged from the analysis, suggesting that the data analysis was saturated (Corbin & Strauss, 1990). It was at this point I drew conclusions to help pin down specific personal factors and organizational conditions that foster an environment whereby high quality implementation of differentiated instruction occurred.

I approached data analysis in three phases. First I compared Sade with other high implementers at North Court School to see if Sade's patterns were recurring with her colleagues or submerged by too many unique factors. Second, I compared the high implementers at North Court with the high implementers at South Court School to see if being a teacher in a low wealth school district changed the pattern. Third, I compared the average implementers, Dana and Fiona, found in the low wealth district with Nina, the low implementer found in the high wealth district looking for commonalities and differences. I would have preferred a low implementer from South Court, the low wealth district, and an average implementer from North Court, the high wealth district, for comparisons but none were available in my sample. I finally give an account of personal factors and organizational conditions across all cases.

Figure 14: Comparison across selected cases

Key: **+ Strong response** **- Weak or opposite response** **± Mixed or neutral response**		**In-Depth Cases**		**North Court School (High wealth district)**			**South Court School (Low wealth district)**			
		Sade High	***Nina*** Low	***Hali*** High	***Lara*** High	***Ria*** High	***Fran*** High	***Dana*** Avg.	***Fiona*** Avg.	***Lisa*** High
Personal Factors										
P_1	Willingness to forge ahead and overcome obstacles	**P_1+**	**P_1±**	**P_1+**	**P_1+**	**P_1+**	**P_1+**	**P_1±**	**P_1±**	**P_1+**
P_2	Willingness to grow professionally after work hours	**P_2+**	**P_2-**	**P_2+**	**P_2±**	**P_2+**	**P_2+**	**P_2±**	**P_2±**	**P_2±**
P_3	Competency with subject matter and implementing complex strategies	**P_3+**	**P_3-**	**P_3+**	**P_3+**	**P_3+**	**P_3+**	**P_3-**	**P_3-**	**P_3+**
P_4	Classroom management skills	**P_4+**	**P_4-**	**P_3+**	**P_3+**	**P_3+**	**P_3+**	**P_3+**	**P_3+**	**P_3+**
P_5	Prior experience teaching same grade level	**P_5+**	**P_5-**	**P_3+**	**P_3+**	**P_3+**	**P_3+**	**P_5-**	**P_5-**	**P_5-**
Organizational Conditions										
O_1	Alignment with organizational structures within the work day	**O_1±**	**O_1-**	**O_1±**	**O_1±**	**O_1±**	**O_1±**	**O_1±**	**O_1±**	**O_1±**
O_2	Alignment with principal's vision for meeting the needs of students	**O_2±**	**O_2-**	**O_2±**	**O_2±**	**O_2±**	**O_2+**	**O_2+**	**O_2+**	**O_2+**
O_3	Available resources and materials	**O_3+**	**O_3-**	**O_3+**	**O_3+**	**O_3+**	**O_3-**	**O_3-**	**O_3-**	**O_3-**
O_4	Professional growth opportunities	**O_4+**	**O_4-**	**O_4+**	**O_4+**	**O_4+**	**O_4-**	**O_4-**	**O_4-**	**O_4-**

Comparison of high implementers across schools

Using the same codes for analysis as outlined in the section for the high and low implementers and described in detail in Appendix L, I compared Sade to the other three high implementers, Hali, Lara, and Ria, at North Court School to look for recurring patterns. The following personal factors were consistent across all four high implementers at North Court: a willingness to forge ahead and overcome obstacles; competency with subject matter and implementing complex strategies; evidence of strong classroom management skills; and experience teaching the same grade level. For example, a review of the interview transcripts showed that Hali, Lara, and Ria approached obstacles with the same proactive outlook as their colleague at North Court. Specifically, Lara shared her views about differentiation with the same conviction as Sade, but also addressing the challenges:

> I think it is necessary to differentiate math so that students are continually learning, being challenged and maintain interest in math. Working with small homogenous groups of students can be easier to manage, plan for, to move forward because they're all in about the same place. Ensuring the rest of the class is working on something meaningful and on task is the difficult part – planning, preparing materials, and managing behavior. (Lara INT – March 3, 2011).

These teachers at North Court also had far more years of experience teaching the same grade level, namely Hali with seven years, Lara with fifteen years, and Ria with ten years, respectively, engaging in more routine experiences to improve their craft. Lara, however, screened as a high implementer during the selection process, had a different response to the other high implementers with a mixed/neutral response to willingness to grow professionally after work hours. When I reviewed the transcripts from Lara's interviews, I found the following excerpt from Lara that explains this coding.

> I think professional development sounds great as long as it fits into faculty meetings built into the existing schedule and were not an additional strand of meetings outside the workday. Also, this theme (differentiated instruction in math) would need to be one area of focus for professional development for it to be done well. (Lara INT – April 26, 2011).

From my informal interviews with Lara, I also learned that she had two small children at home and her private life did not allow much time for training after school hours. Even though Lara's private life constraints resembled Nina's, the low implementer, she was able to manage her workload to implement complex instructional strategies similar to those found in the other high implementers and pursued professional growth opportunities that fit into her own schedule. With the exception (i.e., Lara overcoming personal time constraints and skill implementing differentiated instruction well), the three high implementers at the high wealth school resembled more the 'Sade pattern' than the 'Nina pattern,' bolstering the saliency of the personal factors for high implementation that I identified in the in-depth case study.

Second, I compared the personal factors of the high implementers at North Court, the high wealth district, with the high implementers at South Court, the low wealth district, to see if teaching in a low wealth district changed the pattern. Across the remaining five high implementers at both school sites (e.g. Sade, Hali, Ria, Fran, and Lisa), I found a recurring pattern with three personal factors: willingness to forge ahead and overcome obstacles; competency with subject matter and implementing complex strategies; and evidence of strong classroom management skills. Again, when I compared Sade, Hali, Ria, Fran and Lisa, I found an exception in this analysis with Lisa. Lisa at South Court had similar personal life constraints to Lara at North Court with a mixed/neutral response to a willingness to grow professionally after work hours. A review of the interview notes showed that both Lisa and Lara were able to use their time effectively throughout the day to implement differentiated instruction and took advantage of training that fit into their daily lives. When I scanned the territory again, I also found Lisa was the only teacher who did not have previous experience with teaching her grade level. During my interviews with Lisa, I learned that she had over thirty years of teaching experience but was teaching fourth grade for the first time. During the screening process, I ranked Lisa as a high implementer because she met six out of the eight criteria used to classify high implementers of differentiated instruction (depicted in Exhibit 8). When I asked Lisa to tell me about her teaching experience, she responded:

> Most of my experience has been in third grade math, and I've taken different workshops in math before (Lisa INT – February 24, 2011).

I then reexamined whether prior years of experience teaching the same grade level affected the level of implementation for the remaining high implementers: Sade, Ria, Hali and Fran. In my analysis of these high implementers across both schools, all had five plus years of teaching experience, even though they did not all have similar experiences teaching the same grade (see Figure 6 and 7). Therefore, I concluded that teaching experience was a factor for high implementation. Ria, Hali, Fran and Lisa exhibited similar behaviors as Sade, validating my findings of high quality implementation at this point of my analysis.

Next, I looked at the organizational conditions at North Court to see how they differed from South Court. Generally speaking, teachers at North Court, a high wealth school, were afforded more resources, materials, and professional opportunities as compared to what was available at South Court, a low wealth school. Contrary, teachers at South Court had very limited resources and no additional support of a coach, yet lack of organizational resources did not deter some teachers from implementing differentiated instruction. I asked what may have been the reason for this? To begin with, North Court teachers had the benefit of having resources, such as a mathematics coach, but the resources were not used widely as one could have imagined. Demands put upon teachers during the workday made connecting to additional resources too costly. Thus, resources in the high wealth environment seem to dissipate.

Comparing high wealth and low wealth environments, I found alignment with the principal's vision worth noting. The high implementers at North Court were all equally confused by the principal's philosophy for differentiated instruction and tackled the challenge on their own. However, teachers at South Court viewed the principal as a supportive role model who could assist them when needed. Specifically, when I asked Lisa how the principal supported teachers at South Court, she shared both praise and challenges:

> I think our site administrator is very supportive of us growing. It's just that she has no one at the district to turn for help. We have started peer teaching on site, but that goes really just so far. (Lisa INT – April 21, 2011).

In addition to clear leadership, lack of resources may have also been compensated by competence and experience for the high implementers as in the case of Fran and Lisa, teachers with respectively, 29 and 30 years of teaching experience. High implementers Fran and Lisa at South Court spoke about how to approach the difficult task of differentiating instruction as a challenge to overcome rather than be avoided. Fran tackled challenging situations with a constructive outlook similar to Sade. Both Fran and Sade had a strong desire to provide their students with the necessary time and strategies to grasp the material. Fran expressed her outlook as follows:

> I have students who know *Kuman Math*[25] facts to students who don't even know how to count. The low performing students don't trust their skills so it takes more time and materials to help them understand the concept. I think Math needs to be taught more like

[25] Kumon Math is a comprehensive program that develops the necessary skills to help your children progress from counting through calculus. Source: Kumon. Retrieved October 1, 2011, http://www.kumon.com/GetStarted/

> guided reading. Students need more time to develop their skills and learn their math facts. (Fran INT – February 24, 2011).

Fran did not shy away from the difficult task of differentiating instruction even in the absence of resources and materials. Fran was able to use the materials she had accumulated over her 30 plus years of teaching to implement complex instructional practices for her students. While she expressed a desire for more resources and materials, she was able to use what she had to meet the needs of her students. Therefore, I concluded that being a teacher in a low wealth district with limited resources did not necessarily prohibit high quality implementation of differentiated instruction. Personal determination, superior skill and long experience coupled with explicit principal support for differentiated instruction played an important role.

Comparison of the average and low implementers across schools

In this next phase of my analysis, I examined the patterns that came out of Nina's case, the low implementer at North Court, with cases classified as average implementers at South Court, respectively Dana and Fiona. On the whole, low and average implementers (i.e. Nina, Dana and Fiona) were more similar to each other across the two schools than similar to the high implementers. The former were less inclined to forge ahead and overcome obstacles or to attend professional development workshops outside of their workday. They also exhibited fewer competencies teaching the subject matter and implementing complex strategies.

However, in contrast to Nina, the teacher with the lowest implementation quality of differentiated instruction, the average implementers with their share of challenges, were observed having strong classroom management skills. I concluded that strong classroom management skills were necessary for at least the average implementation quality.

Average and low implementers, Nina, Dana, and Fiona, were all relatively new to their current teaching assignments. While all three were experienced teachers, Nina and Dana were teaching a new grade level for the first time, and Fiona had difficulty meeting the needs of her exceptionally large class of thirty students. As compared to the high implementers, organizational conditions were a source of discouragement or confusion for average and low implementers.

Summary of Personal Factors and Organizational Conditions that Facilitated High Quality Implementation of Differentiated Instruction in Mathematics

In this chapter I first analyzed the data from the two exceptional cases to discern personal factors and organizational conditions that could explain the differences in implementation. I then analyzed the data of the seven remaining cases with varied levels of implementation quality for differentiated instruction to validate my findings within groups of teachers with similar implementation quality, with different implementation quality, and with different contextual conditions.

The findings of this study indicate several personal dimensions that distinguish high implementation from low or average implementation of differentiated instruction in mathematics. The first dimension was the willingness to forge ahead and overcome obstacles. While this may not appear too surprising for teachers of high quality, the finding is consistent with which teachers expressed excitement about the work they do and their determination to

excel. Second, high implementers demonstrated a strong willingness to grow professionally and improve their practice. High implementers were committed to learning even if it entailed attending workshops after the typical workday or exerting additional energy to meet the needs of diverse learners. Third, as seen in my observations of their teaching, high implementers exhibited strong competency, capability and confidence teaching the subject matter and ability to implement complex instructional strategies. They not only could match activities to students' needs but they also had strong classroom management skills needed to multi-task and keep students engaged. The high implementers demonstrated that they could establish complex instruction in a variety of situations. And last, all these factors coupled with prior experience teaching the same grade level increased the level of implementation quality for differentiated instruction to occur.

Next, organizational conditions, specifically lack of resources and materials, did not inhibit high quality teachers from persevering and differentiating instruction. While it was seen as a benefit to have additional resources and opportunities for professional growth, high implementers were also found in the low-wealth school that did not have such support. High implementers at South Court were generally excited about teaching and showed it by carefully planning and organizing each lesson and by nurturing relationships with their students. Organizational conditions, however, namely lack of clear leadership and lack of needed resources, did have an effect on the low and average implementers. But even the high implementers made it clear that the pressure of daily work demands put severe constraints on their ability to differentiate instruction in their classrooms. No amount of skill and determination or ample organizational resources could overcome these constraints.

CHAPTER V – DISCUSSION

Students are not all alike and they learn mathematics in a variety of ways. In most typical elementary classrooms, some students grapple with achieving, and others perform above grade-level standards, while the majority falls somewhere in between. Over the years, differentiated instruction has emerged as a mainstream solution to deliver high quality instruction to diverse learners. Highly regarded by practitioners as a moral imperative for improving learning, the practice of differentiated instruction adjusts the method of instruction within a classroom to match individual students' needs. Teachers have effectively used this strategy to increase student learning and engagement and to improve mathematics instruction. It is one strategy that allows teachers to respond to individual differences within a classroom environment, and ensure students are given equal opportunities to be successful. Traditional elementary schools, however, are often structured in ways that present substantial challenges for teachers in achieving and sustaining high quality implementation of differentiated instruction. Students need committed teachers willing to persevere in this practice, and in turn, teachers need organizational leadership to support them. Leaders make critical decisions on how to promote the vision of the school, how to structure the school day, and how to facilitate collaboration between teachers.

My main practical purpose for conducting this research study was to understand the role of leadership and organizational conditions that leaders could influence to facilitate teachers' levels of implementation of differentiated instruction. This was especially pertinent to me, having served as an educational leader for the past six years in the roles of Principal, Director of Special Education and Superintendent. I was looking for how I might support teachers in the area of differentiated instruction in mathematics in heterogeneous classrooms. To sum up, the practical question that guided my work was: what are the malleable organizational conditions that may be readily influenced by the instructional leader within an organization to assist teachers in implementing differentiated instructional strategies in elementary mathematics classrooms?

To address this guiding question, I needed to know how these presumably malleable factors stack up, or interact with, other factors and conditions less susceptible to leaders' external influence. Toward this end, I began my inquiry with an extensive review of the literature in a variety of areas related to differentiated instruction: theories on learning; mathematical understanding and instruction; ethics and equity; overarching theories of teacher learning; and theories of organizational conditions to guide me through my research study. I found the literature was surprisingly sparse on the topics of how teachers perceived themselves and the support of their organizations in the area of differentiated instruction. I sought to define a variety of factors contributing to high and low implementation. From the onset of this study, I assumed that both personal factors and organizational conditions contributed to the differences in implementation quality. I assumed that teachers' personal characteristics, philosophies, ingrained dispositions, or life circumstances would be quite difficult for an organizational leader to influence. I concluded from the literature that organizational conditions could either be structural (i.e., work hours, intensity and daily demands) or more malleable (i.e., training, support and professional development). Identifying malleable organizational conditions through my study was of particular interest to me. As a leader, I felt I could effect changes in this area, more than with respect to the structural conditions, than the personal dimensions over which I have little control. It was my hope that any new knowledge garnered by this study would provide

educational leaders like myself a better understanding of how to support teachers within a school or organization with the aim of improving the quality of instruction for students in mathematics.

Summary of Findings

Using a case study format, this research focused on interviewing and observing nine elementary teachers who espoused to being committed to meeting the diverse needs of their students in mathematics. The selected teachers were generally optimistic and willing to participate in the study to improve their practice, but also realistic about the challenges of teaching mathematics in a mixed- ability classroom. All participants were focused on providing rigorous learning experiences for their students and were positive about the social and emotional benefits of having students placed in heterogeneous classrooms. While each participant differentiated instruction in mathematics to varying degrees, they all engaged in this study with seriousness and purpose. Participants acknowledged the challenges of teaching students with diverse abilities from special education to giftedness and were confident in their abilities to deliver instruction in the most appropriate way. If there was one variable that all teachers clamored for as a prerequisite, it was time as the most important resource for differentiated instruction. Overall, teachers in the study believed that the main obstacle that made differentiated instruction so difficult to implement was the time needed to plan and exchange with colleagues. They also desired more time in the school day to teach mathematics.

Based on my observations and interviews, I arranged the nine cases according to the way they implemented differentiated instruction. Teachers were ranked as either high, average, or low implementers. Doing this work, I gained an appreciation of the nature of teachers' everyday work with students and what made each teacher unique. I observed the personal challenges teachers encountered within their classrooms, and I talked at length with each teacher about their struggle to meet the diverse needs of their students. Through an in-depth analysis across these selected cases, I was able to identify specific personal factors that were characteristic of teachers who delivered high quality implementation, as well as identify factors as to why teachers exhibited low implementation quality.

I found high quality implementation was present for those classrooms where teachers were committed to forging ahead against all odds of any obstacles within the organization. Surprisingly, organizational conditions such as additional resources and materials, and access to professional development were not necessary for high implementation to occur. For the exceptionally high implementers, personal factors such as willingness to persevere and grow professionally, relatively long experience teaching the same grade level, and solid classroom management skills were in stronger evidence. But even the high implementers expressed concern about the challenges and pressures of their workday demands implementing this practice routinely. Concurrently, I found characteristics of the low and average implementers to be the result of an interplay between personal factors and discouragement pertaining to organizational conditions that were both structural and malleable. For these teachers, the push and pull between their own personal philosophies and organizational conditions were constant. Teachers with lesser implementation quality of differentiated instruction expressed less perseverance and less certainty of their skills and experience to master complex instruction. Moreover, they were discouraged by the structural conditions that existed within their organizations and could not see a clear path for implementing such practice. These teachers were frustrated by large class size and the confusing ways that student learning groups were composed at their schools. In addition,

they interpreted daily workday demands as a roadblock for putting into practice good instructional practices. They clamored for more planning time, meetings with colleagues, and attending professional development outside their workday. And yet, when resources were offered, they did not know how to productively take advantage of them.

In short, high implementers were determined and experienced in their teaching assignment. They had command of their classroom and were able to manage complex forms of interactions. They were driven by their own personal concern between what they perceived their students' needs to be and what they could reasonably offer. If anything, they focused their energy on good instruction and utilized organizational resources they perceived of value. Teachers with less implementation quality selectively fed on the mixed messages of the organization and could not procure necessary resources. They sensed dissonance between student needs and their ways of teaching, but they did not feel they could remedy this situation given their skill level, extenuating personal circumstances, and a feeling of being overwhelmed by the daily demands of teaching. Here the low implementers were not alone. Even the teachers with the highest commitment and best implementation quality saw severe constraints for including differentiated instruction in regular every day teaching.

Study Limitations

It should be noted that conclusions I reached had limitations. One such limitation is the size of my sample. Prior to beginning my study, I interviewed the principals at North Court and South Court to make sure there was a wide spectrum of teachers with a different range of teaching abilities interested in participating in my research. I took every precaution to increase my sample size at both school sites to include teachers with varying reputations as stronger or weaker to avoid self-selection of strong teachers. I not only solicited input from the principals but I attended a faculty meeting at each site to explain my study to interested participants and invite teachers to volunteer. I also included a screening observation protocol to make sure my sample included participants with high, low, and average teaching strength. I actively reached out and initially retained fifteen subjects. When it came time to observe and interview the participants, only five teachers from North Court and four teachers from South Court could commit to the timeframe needed to complete this study. Presumably, it may have been the weaker teachers who opted out. As a result, only one teacher was classified as a low implementer at North Court. My sample did not include a low implementer at South Court. Given how difficult it is to implement good differentiated instruction, having a sample with two-thirds high implementers was not desirable, but unfortunately, the best I could hope for.

The way I tried to correct for this was to pursue an in-depth analysis of two exceptional cases to capture the specific factors and conditions for the high and low implementers. The purpose of this synthesis was to establish validity for each individual case, and to compare the patterns across these two in-depth cases. To strengthen my findings further, I conducted a subsequent analysis fitting the other seven cases by using the dimensions of the exceptional two cases as anchors for comparison. During this analysis, the data revealed such common philosophical and attitudinal dimensions for the high and low implementers.

Additionally the data collected within the nine cases were limited to interactions between teachers and not students. Specifically, I focused data collection on the observations and interviews of teachers representing my findings only on the teacher's perspective. The choice to study teachers was intentional based on my interest as an educational leader to impact teachers'

instructional practice. The data were not empirically tested to draw conclusions on whether the students who were taught by high and low implementers performed differently. As a result the findings of this study are insufficient to draw generalized relationships between differentiated instruction and student performance. Therefore, more longitudinal studies investigating the impact of differentiated instruction on student learning outcomes are needed.

To validate my findings and to mitigate any bias that may have unduly influenced my study, I continually examined and reflected upon my own practice and reviewed my findings with critical friends (Creswell, 2009) to ensure that my conclusions were supported by the data found throughout this study. Comparing contrasting cases into a continuum and creating certain pattern coherence gave me analytical distance and dissociated me from potential bias. Research colleagues acting as peer reviewers confirmed the process of data collection, reviewed the results of how the study was conducted and data were analyzed, and ensured the findings were represented with appropriate accuracy, fairness, and lack of bias.

Implications and Recommendations for Leadership and Practice

Teaching mathematics to students with mixed-abilities can be complicated for the average teacher who has little skill in the practice of differentiating instruction. This is because differentiated instruction is not a strategy that a teacher can easily churn out, and it requires organizational support to cultivate the skills needed for implementation. My findings show that no amount of skill, determination, experience, or resources could overcome the drain of daily workday demands and the additional time needed for high quality implementation.

I found that many of the participants continued to work in fairly isolated conditions even when the organizational leader endorsed ideas of collaboration to meet the needs of individual students. If anything, high implementers concentrated all their energies on their own classroom and professional growth needs, while teachers with lesser abilities felt more alone. Even the participants who had access to additional resources could not find the time during their workday to utilize such support. But there were some structural factors or conditions leaders could attend to. Specifically, clear messaging, distribution of the workload demands, and flexibility came through as important. But it needs to be recognized that structural conditions are not easily changed. And given that one of the districts was a high wealth district, the prospects even for superintendents to make such headway here are sobering.

Organizational leaders need to understand the demands teachers are faced with every day and the complexity of implementing new initiatives. Through this study I came to understand the significance of an average teacher's skill and workload expectations in contributing to the challenges of implementing differentiated instruction. Leaders cannot expect every teacher within the organization to perform at high levels, and are faced with the challenge of pushing employees to the brink of failure. Even high quality implementers found that differentiated instruction could not be executed on a daily basis and sought additional pre-made resources from publishers to enhance the curriculum in meeting the needs of diverse learners. As a result, the implications of this study serve to generate several suggestions and recommendations that leaders may want to consider if they seek to improve high quality instruction in the area of differentiated instruction in elementary mathematics.

The first implication of this study suggests that personal factors play a key role in the facilitation of differentiated instruction. From the onset, I believed that I could influence change as a leader in my own district in the area of differentiated instruction through malleable

organizational conditions. During the study, I found that these kinds of organizational conditions did not play a significant role in whether a teacher was classified as a high or low implementer. I found instead that personal factors were more salient and are less susceptible to the leader's influence. High implementers were driven to find solutions and implement strategies that benefited their students even if it meant planning lessons or attending workshops outside of their normal workday. For the teachers with less implementation quality, reasons preventing them from putting into practice differentiated instruction included a lack of time to plan instruction, ambiguous messages from the principal on grouping students, and most of all, personal life constraints.

The second implication of this study suggests that the typical teacher may be overtaxed by the complexities of the task. I found all nine participants were consumed by their current workload demands, and had limited time during the workday to plan lessons. Yet, they could see their students were in need of differentiated support. Overall, teachers expressed a sense of frustration that demands were always in excess of available time and resources. This calls to mind the common expression 'something's got to give' if change is to happen. Leaders cannot expect every teacher to be a 'miracle worker' as some of the high implementers appeared to be who spent long hours after school to get their teaching right.

A third implication of this study suggests that differentiating instruction in mathematics is an arduous task. High quality implementation is not something an organization can prescribe to a teacher on the spot, but instead is a practice, skill, and disposition that are embedded in a whole host of other skills that are gained over time. As a result, all strategies regarding differentiated instruction need to be long-term and address the 'whole teacher.' Workshops on isolated techniques will probably not do much good.

A fourth implication has to do with work place structures. Throughout the study, teachers spoke about their frustrations with the structure of their school days, and concern about clarity, coherence, and commitment on the part of their organization to provide the necessary supports for such complex instruction to occur. Malleable structural changes that were suggested included a review of teacher assignments and additional duties, time for collaboration, and changes to the schedule to allow more time in the day to teach math.

A final implication had to do with the way professional development was offered and delivered within the organization. All nine participants desired on-going training in both mathematics and differentiated instructional practices throughout the school year to improve their skills. Only a few participants welcomed summer opportunities for training. Overall, teachers at both school sites had regularly scheduled weekly faculty meetings that they did not feel were used effectively. From their perspectives, too much time was spent on the part of the school leader communicating information on the day-to-day needs of the operation. If anything, the participants all believed these matters could have been resolved with the use of email communication leaving time for collaboration and training. A practical suggestion offered by teachers for how leaders can deliver a more effective training model began with a clear message by the leader focused on 'fundamental understandings' that are most valued by the organization. In other words, the participants expressed the need for an uncomplicated definition on what it meant to differentiate instruction within their respective organization. Beginning with a mutual understanding, the participants looked to the school leader to help build a strong support system for collaboration that included visiting other teachers' classrooms, creating book talks or study groups on differentiation, peer-to-peer coaching, and co-teaching models.

Researcher's Self-Reflection

Much of my professional teaching career has been focused on differentiating instruction, especially in mathematics, for both elementary and middle school students. As a teacher, I worked endless hours to ensure that my lessons were differentiated to meet the needs of my students. My concern for closing the achievement gap in mathematics, and desire for excellence and high quality experiences for students, are the reasons I pursued this study. I knew from my own personal experiences that implementing differentiated instruction overtaxed me as a teacher and was ultimately one of the reasons why I pursued administration. I believed that through this study I could offer insight and suggestions that would make this problem of practice easier to implement; there had to be some way that I could influence change as a leader. Hence, this study was developed to help other teachers and leaders like myself understand the complexities of implementing such practice. I hoped to possibly find specific organizational conditions that could be simply changed to ensure high quality teaching. As I found out, there is not a prescriptive list that can be easily transferred to other educators or organizations.

As a superintendent, I am humbled by what I have learned and by the challenges ahead. I feel a kindred bond not only to the teachers who voluntarily participated in this study but for those who I will continue to encounter in my every day work. For those teachers who willingly forge ahead, I commend them for their passion. I also commend those teachers seeking to improve their craft, and those leaders willing to take a step back and understand the complexities of human change. In today's classrooms many of the benefits of creativity and positive relationships with students go unnoticed, and yet there is an increased focus on metrics and accountability. Public school educators work within socially constructed mandates institutionalized by federal and state governments. This study suggests that high implementation of differentiated instruction exists not because of the organization, but despite of it, as it seems to require tremendous personal commitment, drive, and willingness to go far beyond the call of normal duties.

This experience and study has taught me that there is a tremendous amount of confusion and even controversy about what it means to differentiate instruction. Many educators are confused about the broad principles and strategies used to implement this practice since there is no clear recipe for differentiation. Instead, it can be defined into classroom practice in many different ways. The findings in this study offer suggestions that are worthwhile and valuable to any educator seeking to improve the quality of instruction for students.

As superintendent, I proffer that leaders must be reflective about their own assumptions, skills, and perceptions in order to improve practices in the classroom. They need to have a clear understanding and focus on the challenges of leading a change effort. I had my own biases and beliefs that differentiated instruction could be easily implemented with support from the organization. I would even offer that I had an unrealistic expectation that an average teacher could easily implement such practice without systemic changes. In my mind, low implementation of differentiated instruction was a weakness, but I am now of a different mind. Leaders need to step back and realistically assess what their organization is able to offer a teacher with average skills and ordinary commitments to their own family. Moral purpose and moral clarity cannot overcome structural obstacles and even the best can only go so far. I clearly did not understand this challenge at the onset of this study. With that said, Carol Tomlinson, in her framework for building capacity within schools (1999), describes the role of leadership this way:

Don’t ask teachers to do something shrouded in uncertainty. Be sure you are clear on your definitions of goals for differentiation. Explain these definitions and goals so other can examine them and talk with you about them. Then do a difficult thing: hold the vision with one hand and reach out with the other to invite other leaders, teachers, and parents to revise and extend that vision. It is a paradox of change that leaders must believe in their ideas but be open to the reality that the others must shape those ideas for change to truly happen. (p. 109).

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APPENDIX A:
OPERATIONAL DEFINITIONS FOR ORGANIZATIONAL CONDITIONS

Influencing norms and values

- Teachers and school administration's social agreement on the strategic and educational goals for differentiation (Louise & Kruse, 1995).
- Teachers and school administration's sense of affiliation with each other and with the school and their sense of mutual support and individual responsibility for the effectiveness of instruction are evidenced by collaborative work with peers (Louise & Kruse, 1995).
- Teachers and school administration's valuing of after-school support for failing students and after-school enrichment classes for gifted students suggests teachers value differentiation as a means to improve student achievement and performance (Louise & Kruse, 1995).
- Teachers and school administration's value the central importance of teaching diverse groups of students as evidenced by teachers constantly assessing students through observations, tests, and written work.
- Differences among the students are identified and targeted for accommodation based on overall philosophy of student support services for all students (e.g. student study meetings provide resources where teachers receive support to adjust content, process, and product in response to student readiness, interests and learning profile.

Use of available resources and materials

- Teacher grants are available to teachers to purchase additional materials to differentiate instruction.
- Standards-based curriculum and resources are provided by the district to teachers.
- Collective responsibility for instruction is evidenced by increased assistance between administration and teachers for instruction.
- District/school provides materials and resources which encourage individual student growth, incorporate activities that demonstrate a wide range of learning styles, interests and abilities, and provide suggestions for what to do when an activity is completed (Tomlinson, 1999).

Quality Professional Development

- District offers professional development that supports differentiation of the curriculum (e.g. GATE conference, annual math conference, language arts adoption, etc.).
- Professional development for mathematics is ongoing as evidenced by support of outside consultants who meet regularly with teachers to collaborate on practice, instruction and assessment.
- Embedded professional growth opportunities that allow teachers to engage in thoughtful reflection and time to understand the content more deeply and discuss differentiated strategies are available to help diverse students (Resnick & Hall, 1998).
- Structural conditions that create work settings that foster collaboration in other parts of the school such as physical resources, coordination among teachers, communication and autonomy affect practice (Louise & Kruse, 1995).

APPENDIX B:
OPERATIONAL DEFINITIONS FOR PERSONAL FACTORS

Highly motivated to forge ahead

- Strong sense of efficacy as evidenced by the importance of frequent reactions to performance from peers and supportive school leaders. Sense of efficacy, in turn, is related to personal commitment to teaching and students (Louise & Kruse, 1995).
- Individual accountability and motivation found through meaningful participation in school-wide decisions/committees about differentiated learning (Louise & Kruse, 1995).

Student-centered and committed to equity

- Teacher's beliefs and values fundamentally support all children as academically capable and provide learning environment responsive to and supportive of student achievement (Louise & Kruse, 1995).
- Teacher committed to providing high quality instructions to all students through recognizing the importance of unique learning styles maximizing growth and individual success (Murray & Jorgensen, 2007).
- Teacher expects all students to know, understand, and respect each other and value differences (Murray & Jorgensen, 2007).
- Teacher prepares students to expect different assignments because of interest, skill levels, and learning styles.
- The equity principle as described by NCTM in mathematics education requires that all educators assert that excellence in mathematics is the result of teachers who have high expectations and provide the differentiated support to meet the needs of diverse learners in an equitable, challenging, and supportive environment.

High degree of teachers' skills as evidenced by the following…

- **Teacher is knowledgeable about elementary mathematics in a way that reflects a deep and complex understanding of several intertwined conceptions of content and pedagogy that most often are built up by teachers over time and is what constitutes mathematical proficiency (Ball & Bass 2000).** A broad research base on teaching and learning of elementary mathematics conducted by National Research Council (2005) indentifies these intertwining conceptions as (1) conceptual understanding, which is the comprehension of mathematical concepts, operations and relations, (2) procedural fluency, which is the skill in carrying out procedures flexibly, accurately, efficiently and appropriately, (3) strategic competence, which is the ability to formulate, represent and solve mathematical problems, (4) adaptive reasoning, which is the capacity for logical thought, reflection and justification, and (5) productive disposition, which is the habitual inclination to see mathematics as sensible, useful and worthwhile, coupled with a belief in diligence and one's efficacy (p. 218).
- **Teachers possesses the conceptual understanding of mathematics and varied instructional approaches in order to support and challenge students** (NCTM, 2002). Teachers are able to identify what a student knows and then develop and implement strategies that best support each child.

- **Teacher defines teacher/student responsibilities:** All students and teachers are learners in the room so thinking is made transparent – think-alouds are modeled by the teacher and supported by small group, partner and whole group instruction (Murray & Jorgensen, 2007).
- **Teacher differentiates curriculum in mathematics:** Students have different work assignments because of interest, skill levels and learning styles; all work is documented. (Murray & Jorgensen, 2007).
- **Teacher gives clear behavior expectations:** Students are clear about the expectations; acceptable voice and noise levels; asking for help when needed; respectful listening skills are critical and independence and self-starting is nurtured and valued (Murray & Jorgensen, 2007).
- **Teacher establishes routines:** Students know routines, knowing when to enter and move around the room; students are expected to stretch their thinking for all assignments: lessons, projects, and activities (Murray & Jorgensen, 2007).
- **Teacher sets parameters for use of space and time:** Classroom time is focused on mathematics with a serious purpose; specified time limits, time on task, stray movement control and use and care of materials (Murray & Jorgensen, 2007).

APPENDIX C: DATA COLLECTION

	Task	*Protocol*
1	Classroom observations to observe and classify volunteer participants	Initial Classroom Observation Scale (COS-R)
2	Analyze COS-R results and select four –twelve participants for study	
3	Initial interview with each of the selected participants	Teacher Pre-Observation Interview Protocol (TIP-1)
4	1st classroom observation of each of the selected participants	Teacher Observation Protocol-1 (TOP-1) Teacher Observation Protocol-2 (TOP-2)
5	Post-observation interview with each of the selected participants	Teacher Post-Observation Interview Protocol-2 (TIP-2)
6	Document review – relevant lesson plans, resources, materials	
7	Follow up/closing interview with each of the selected participants	Teacher Closing Interview Protocol-3 (TIP-3)

CODES

Preliminary suggestions for coding personal factors					
Expectations for students		**Teacher's norms for student behavior**		**Skills and expertise in differentiating instruction in mathematics**	
CP	Connects prior knowledge	**EQ**	Equitable climate	**KS**	Knowledge of subject matter
IS	Uses instructional strategies	**ET**	Efficient use of time	**SK**	Skill in differentiation
AG	Articulates goals	**EE**	Engaging environment	**OC**	Organizes curriculum
FC	Facilitates choice	**SB**	Standards for behavior	**UL**	Understands learning styles
SD	Promotes self-directed activities			**MR**	Uses materials & resources
CE	Committed to equity			**HM**	High motivated to forge ahead
Preliminary suggestions for coding organizational conditions					
Norms and values		**Available resources and materials**		**Quality professional development (PD)**	
CD	Commitment to differentiation	**AM**	Availability of materials	**OPD**	On-going PD
CD	Commitment to diversity	**AR**	Availability of resources	**FPM**	Focused PD on math
ES	Equitable supports in place	**AT**	Available time to collaborate	**FPI**	Focused PD on differentiated instruction
SE	School-wide sense of efficacy			**EPD**	Embedded PD during the day

APPENDIX D: STRATEGIES FOR BUILDING TRUST IN CONDUCTING RESEARCH

A goal of this research study is to enhance the lives of educators through organizational change. In order to create an environment conducive to conducting this research at a school site, several tips as outlined below are meant to build trust with the teachers and reduce defensiveness (Bryk & Schneider, 2002; Coghlan & Brannick, 2005).

1. Be open, transparent and friendly about the action research, sharing professional experiences to encourage dialogue.

2. Listen and answer questions in a non-judgmental way.

3. Explain the outcome of the research is to support teachers and is not meant to be evaluative.

4. Review the process of informally observing teachers and asking them when the researcher can visit their classrooms.

5. Set schedule for the visits, praising teachers for their assistance and involvement.

6. After initial informal observations, continue to informally discuss the study with participants and seek willing participants.

7. Continue to keep all lines of communication open and transparent – providing support and assistance to teachers as needed.

APPENDIX E: STRATEGIES FOR COLLECTING QUALITATIVE DATA THROUGH INFORMAL AND OPEN-ENDED INTERVIEWS

Suggestions for asking questions during interviews are taken from Patton (2002).

Behavior and Experience Questions
- If I followed you during the day, what would I see you doing?
- What experiences have you had teaching _____(e.g. elementary mathematics)?
- If I were teaching with you, what would I be doing?

Opinion and Value Questions
- What do you think about _____(e.g. teaching elementary mathematics)?
- What would you like to see happen with _____?
- What is your opinion on_____?

Feeling Questions
- How do you feel about _____(e.g. teaching mathematics)?
- What does it look like when you _____ (e.g. differentiate instruction in mathematics?

Knowledge Questions
- Do you know what resources are available to you for_____(e.g. differentiating mathematics instruction)?
- Do you understand how to _____(e.g. vary instruction in mathematics)?

Sensory Questions
- What does it look like when_____?
- When someone walks in the room, what do they see?
- Tell me what I would hear/see, if I walked into your classroom?

Background/Demographic Questions
- How many years have you been teaching elementary mathematics?
- Have you any experience with_____? Tell me more.

APPENDIX F: INITIAL CLASSROOM OBSERVATION SCALE-R (COS-R) TEACHER OBSERVATION TOOL (TOT)

Note: The **Teacher Observation Tool** is based on the conceptual framework of behaviors to be observed and explained in the areas varied delivery of instruction (B1), multiple resources and materials (B2), and grouping students flexibly (B3). Teachers are rated on characteristics observed using a Likert scale of 1-8 (1 = not observed, 2 = somewhat observed, 3 = effective). For example, an overall rating of 6 to 8 will indicate a teacher implements all three behaviors. A rating of "not observed" was also included because it is likely that not all behaviors will be observed in a 30-50 minute lesson. Each item is rated on an individual and self-contained basis. This information will be used to observe all volunteer participants and classify participants for the selection of four participants to be selected for this study.

3 = Effective *(Total Score 6-8)*	**2 = Somewhat Effective** *(Total Score of 3-5)*	**1 – Ineffective** *(Total Score of 1-2)*	**N/O = Not observed**
The teacher evidenced careful planning and classroom flexibility in implementation of six to eight strategies in the following categories (1) varied delivery of instruction, (2) used multiple resources and materials, and (3) grouped students flexibly.	The teacher evidenced some planning and/or classroom flexibility in implementation of the behaviors observed and was observed implementing three to five strategies most of the time.	The teacher demonstrated little or no planning and/or classroom flexibility in implementation of the behaviors observed and was observed implementing one or two strategies.	The teacher evidenced demonstrated no planning and/or classroom flexibility in implementation of the behaviors observed and did not implement any of the eight strategies.

Differentiated teaching behaviors and characteristics to be observed and explained	
The teacher…	**Frequency**
B1 = Varies delivery of instruction (VD) 1. Engaged students in planning, monitoring, or assessing their own learning **(FC)** 2. Encouraged students to express their thoughts **(EE)** 3. Had students reflect upon what they learned **(SD)** 4. Incorporated activities for students to apply new knowledge **(KS)**	
B2 = Uses multiple resources and materials (MR) 5. Accommodated individual and subgroup differences (e.g. through student or teacher choice in material selection and task assignment **(IS)** 6. Encouraged multiples interpretations of events and situations through use of materials/resources **(MR)**	
B3 = Groups students flexibly (GF) 7. Provided opportunities for independent or group learning to promote depth in understanding content **(AG)** 8. Accommodated individual and subgroup differences (e.g. through individual conferences) **(EQ)**	
SCORE:	
COMMENTS:	

APPENDIX G: INITIAL INTERVIEW
TEACHER PRE-OBSERVATION INTERVIEW PROTOCOL-1 (TIP-1)

Note: The questions below are a guide for inquiry with a focus on understanding the heterogeneity in the classroom and how the teacher diagnoses students in order to differentiate instruction in mathematics.

Time of Interview:	
Date:	
Place:	
Interviewer:	**Diana Abbati, Researcher**
Interviewee:	
Grade:	

Research Question: Differentiating Instruction: Understanding the personal factors and organizational conditions that facilitate differentiated instruction in elementary mathematics classrooms?

Thank you for agreeing to do an interview with me today. Is it okay with you if I tape record this interview? I would like to begin and have a few questions that may take some reflection.

Interview Questions:

1. Tell me about your experience in teaching and learning of elementary mathematics?

2. Tell me about the performance levels of the students.

   Probing questions:
   a. Tell me about your students and their abilities.
   b. Tell me about their learning differences (*ELL, Gate, SPED)*

3. What are your expectations for student learning and thinking in regards to teaching elementary mathematics?

   Probing questions:
   a. How would you describe how they perform?
   b. How would you describe the difference between how high and low students perform?

4. Thinking about students in your class, what are the challenges of teaching students with mixed-abilities in mathematics?

   Probing question:
   a. Tell me more about the challenges of teaching them math.

5. What do you think is most important in teaching mixed ability students mathematics?

6. Describe what a typical math lesson looks like in your classroom and how the students behave?

   Probing question:
   a. Tell me more about student behavior.
   b. How do you motivate students with mixed-abilities?

7. Tell me more about the strategies you employ in your class when teaching mathematics?

   Probing question:
   a. How do you think you will address the needs of high and low performing students?

8. How do you know that your students are learning mathematics?

   Probing question:
   a. Tell me about the diagnostic tools you use to assess student learning?
   b. Tell me how you feel teaching mathematics in a mixed-ability classroom?

9. Is there anything else you'd like to add before we end the interview?

   I'd like to thank you for your time today. It's very much appreciated.

APPENDIX H: TEACHER OBSERVATION PROTOCOL-1 (TOP-1)

The purpose of this research study is to understand what personal factors and organizational conditions facilitate differentiated instructional practices in mathematics classrooms. During the observation, I will be recording information into three sections: time, descriptive notes and reflective notes.

In trying to understand how a differentiated mathematics program unfolds, the focus of this observation will be on teacher instructional strategies and behaviors, specifically:

- Teacher's expectation for students
- Teacher's norms for student behavior
- Teacher's skills and expertise in differentiating instruction

With input from the teacher, I will be observing how the teacher differentiates instruction for students with mixed abilities, specifically focusing on 2 high, 2 average, and 2 low performing students.

Time	***Observation Notes (Real Time)***	***Descriptive Notes (Real Time)***	***Reflective Notes***

APPENDIX I: TEACHER OBSERVATION PROTOCOL-2 (TOP-2) – Page 1

Note: During the observation, focus will be on classroom instruction, specifically: (1) teachers' expectations, (2) teachers' norms for student behavior and (3) teachers' skills and expertise (*adapted from California Teaching Standards)*. This protocol will be used to as a way to jot down frequency of events. Comments will also be recorded.

Teacher: _____ Grade:_____ Date:_____

A. Expectations for students	**Frequency**	**Comments**
1. Connects students' prior knowledge, interests and life experiences with learning goals of the lesson **(CP)**		
2. Uses a variety of instructional strategies and resources to respond to diverse needs **(IS)**		
3. Articulates short-term and long-term goals for individual and group work **(AG)**		
4. Facilitates learning experiences that promote choice **(FC)**		
5. Promotes self-directed, reflective learning for all **(SD)**		
6. Committed to providing equitable learning experiences **(CE)**		

APPENDIX I: TEACHER OBSERVATION PROTOCOL-2 (TOP-2) – Page 2

B. Teacher's norms for student behavior	**Frequency**	**Comments**
1. Establishes a climate that promotes fairness and respect with a focus on teaching/learning of mathematics **(EQ)**		
2. Teacher answers questions when needed and use time efficiently **(ET)**		
3. Creates a physical environment that engages all students **(EE)**		
4. Establishes and maintains standards for student behavior that support student learning **(SB)**		
C. Skills and expertise in differentiating instruction in mathematics	**Frequency**	**Comments**
1. Demonstrates knowledge of subject matter content and student development **(KS)**		
2. Establishes routines for beginning and ending class; changing workstations; sets parameters of workspace and time; and collecting/returning student work **(SK)**		
3. Organizes curriculum to support student understanding of the subject matter **(OC)**		
4. Provides clears directions for auditory, visual and kinesthetic learners (e.g. utilizes task cards, charts, white boards, peer helper, etc.) **(UL)**		
5. Uses materials and resources to make subject matter accessible to students **(MR)**		

APPENDIX J: TEACHER POST-OBSERVATION INTERVIEW PROTOCOL-2 (TIP-2)

Note: The questions below are a guide for inquiry with improvement with a focus on understanding the personal factors and organizational conditions that may facilitate differentiated instruction in mathematics. Questions will be refined as needed to clarify, deepen and expand my understanding of the themes that emerge from the data.

Time of Interview:	
Date:	
Place:	
Interviewer:	**Diana Abbati, Researcher**
Interviewee:	
Grade:	

Thank you for agreeing to do an interview with me today. My research question is to understand the personal factors and organizational conditions that facilitate differentiated instruction in elementary mathematics classrooms. Is it okay with you if I tape record this interview? I would like to begin and have a few questions that may take some reflection.

Interview Questions:

1. Thinking back on your lesson, what aspects do you think worked well?

   Probing questions:
   - *a.* Tell my why it worked well.
   - *b.* I noticed that you…tell me about that aspect of the lesson?

2. What aspects of the lesson seemed to not work out?

   Probing question:
   - *a.* What would you have done differently? Why?

3. How is teaching mathematics in a mixed-ability classroom, different from other content areas? Why?

4. Describe how the students behaved during the lesson?

   Probing question:
   - *a.* What, if anything, would you have liked to see done differently?

I am interested in learning more about what supports are in place in the school to help teachers and students in the teaching and learning of mathematics.

5. Describe what kinds of supports are needed to ensure students of all abilities succeed in math?

Probing questions:

a. What can you tell me about the math program used?
b. What type of structures would you like to see change if any (e.g. time, materials, resources)?

6. What supports would you like to see put in place to help students increase their knowledge of mathematics?

   Probing questions:

   a. Tell me more…
   b. What if those barriers didn't exist?

7. What resources and materials could you use to teach the mathematics to diverse students?

   Probing questions:

   a. Tell me…what are some things you don't like about the resources available to you?
   b. What you like to see…
   c. Tell me more about…

8. What type of opportunities would you like to see for teachers (e.g. professional development, time, resources, materials)?

9. Tell me about the school leadership's values and beliefs about mathematics and heterogeneously grouping students for mathematics.

10. Tell me about the school leadership's values and beliefs about differentiating instruction in mathematics.

    Probing questions:

    a. What is your opinion of differentiated instruction as a strategy for teaching mathematics?
    b. What's easy about differentiation and what's hard? Why?
    c. What, if any, do you perceive as obstacles for implementing differentiated instruction in elementary mathematics?

11. If you had the power to change things about the school program, what would you make different?

12. Is there anything else you'd like to add before we end the interview?

    I'd like to thank you for your time today. It's very much appreciated.

APPENDIX K: TEACHER CLOSING INTERVIEW PROTOCOL-3 (TIP-3)

Note: The questions below are a guide for inquiry with improvement.

Time of Interview:	
Date:	
Place:	
Interviewer:	**Diana Abbati, Researcher**
Interviewee:	
Grade:	

Thank you for agreeing to do this interview with me today. My research question is to understand the personal factors and organizational conditions that facilitate differentiated instruction in elementary mathematics classrooms. I am interested in learning more about what supports are in place in the school to help teachers and students in the teaching and learning of mathematics.

Is it okay with you if I tape record this interview? I would like to begin and have a few questions that may take some reflection.

Interview Questions:

Questions will be modified and refined based on the data from the prior interviews and observations and serve to clarify, deepen, and expand my understanding of the themes that emerge from the data. The focus of this interview will be to deepen my understanding of the interplay between personal and organizational factors that may facilitate differentiated instruction and what specific treatments, if any, the participants would like to see implemented.

APPENDIX L: CODES FOR ANALYZING DESCRIPTIVE BEHAVIORS

Coding procedures for analyzing interview and observation data:

- \+ = **Strong presence, response or observed behavior**
- \- = **Weak presence, response or observed behavior**
- $\underline{+}$ = **Mixed or neutral presence, response or observed behavior**

Code	*Description*	*Rating/Indicator(s)*	
P_1	Willingness to forge ahead and overcome obstacles	P_1+	Positive response to interview questions
		P_1-	Negative response to interview questions
		$P_1\underline{+}$	Neutral or mixed response to interview questions
P_2	Willingness to grow professionally after work hours	P_2+	Positive response to interview questions
		P_2-	Negative response to interview questions
		$P_2\underline{+}$	Neutral or mixed response to interview questions
P_3	Competency with subject matter and implementing complex strategies	P_3+	Strong presence observed during classroom observations
		P_3-	Little to no presence observed during classroom observation
		$P_3\underline{+}$	Moderate presence observed during classroom observations
P_4	Classroom management skills	P_4+	Strong presence observed during classroom observations
		P_4-	Little to no presence observed during classroom observation
		$P_4\underline{+}$	Moderate presence observed during classroom observations
P_5	Prior experience teaching same grade level	P_5+	Positive response to interview questions
		P_5-	Negative response to interview questions
		$P_5\underline{+}$	Neutral or mixed response to interview questions

Code	*Description*	*Rating/Indicator(s)*	
O_1	Alignment with organizational structure within the workday	O_1+	Positive response to interview questions
		O_1-	Negative response to interview questions
		$O_1\underline{+}$	Neutral or mixed response to interview questions
O_2	Alignment with school principal's vision meeting the needs of students	O_2+	Positive response to interview questions
		O_2-	Negative response to interview questions
		$O_2\underline{+}$	Neutral or mixed response to interview questions
O_3	Available resources and materials	O_3+	Positive response to interview questions
		O_3-	Negative response to interview questions and/or not available
		$O_3\underline{+}$	Neutral or mixed response to interview questions
O_4	Professional growth opportunities	O_4+	Positive response to interview questions
		O_4-	Negative response to interview questions and/or not available
		$O_4\underline{+}$	Neutral or mixed response to interview questions
O_5	Utilization of available support from math coach	O_5+	Positive response to interview questions
		O_5-	Negative response to interview questions and/or not available
		$O_5\underline{+}$	Neutral or mixed response to interview questions