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An insider's view: an exploration of implementing the common core standards for mathematical practice for elementary teachers in a rural Louisiana charter school

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AN INSIDER’S VIEW: AN EXPLORATION OF IMPLEMENTING THE COMMON CORE STANDARDS FOR MATHEMATICAL PRACTICE FOR ELEMENTARY TEACHERS IN A RURAL LOUISIANA CHARTER SCHOOL

A Dissertation

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for degree of Doctor of Philosophy

in

The School of Education

by

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December 2013
I dedicate my dissertation first of all to my family: Mark, my husband, with whom I have now spent more than half my life, has supported my intensity in ways both big and small. He has consistently been supportive, which helps me to maintain perspective. I am grateful for how well he understands me and helps me understand myself, and for the room and freedom I have always had to grow. All that I owe to him I cannot even put in words. For my sons, Ahren and Jordan; daughter-in-law, Randi; mother, Linda; sister, Holly; and brother, Kevin who have supported me throughout the journey. I will always appreciate all that they have done. To my nieces and nephews—may all your dreams come true.

For my granddaughters, Tara Morgan and Teagan Marie, this dissertation has filled too big a proportion of your young lives. Tara has always been the one to work alongside me in “doing research” with her paper and pen. Teagan is too young to even understand what is going on.

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A special dedication of this dissertation is in memory of two very special friends and mentors - Janet C. Langlois, my former supervisor, and Marge Arnold who was like another mom to me.
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ABSTRACT

This qualitative single case study in a rural start-up charter school in North Louisiana explored the impact that professional learning from Whole-Faculty Study Group sessions had on teachers’ understanding of the most significant contributions of the Standards for Mathematical Practice in preparation of the implementation of the Common Core State Standards for Mathematics (CCSSM). The theoretical framework proposed that structured time for collaboration would enhance teachers’ understanding of the math practice standards. The literature indicated that collaborative job-embedded professional learning can lead to improvements in teachers’ knowledge and practice and that understanding the Standards for Mathematical Practice is key to the successful implementation of the content standards. According to the interview and questionnaire responses from the six teachers and leadership team members who participated in this study, along with an analysis of records and observation notes, participants’ collaborative professional learning in the study group sessions had a positive impact on their understanding of the value of collaboration and their perceived importance of the math practice standards. Themes about collaboration that emerged from the data analysis indicated that the purpose of collaboration was to empower teachers and establish common goals and that successful collaboration requires structures in place and supportive resources. Themes that emerged about the math practice standards were that the standards develop mathematically proficient students, deepen teachers’ mathematical knowledge, and change the teacher and student roles, with teachers assuming a more facilitative role and students taking a more active role in their own learning. The findings were supported by the literature, with the caveat that the scope of the study precluded following teachers as they applied their deeper understanding of the math practice standards to implementing the standards. Recommendations emphasize ensuring
that CCSSM implementation leads to significant changes in teacher practice and student learning and that educators at all levels have the time and support they need work together collaboratively. Further research suggested includes expanding this study, more research on the impact of job-embedded teacher collaboration on teacher practice and student learning, and more research on implementing the CCSSM standards and assessments and assessing the results.
CHAPTER 1: INTRODUCTION


Statement of the Problem

Mathematics instruction in the United States has a long history of confidence in standards and curriculum programs as the primary means to improve student achievement (Larson, 2009). However, reliance on standards and materials to improve student achievement has not resulted in dramatic improvements in student learning, and more importantly, it has not resulted in a narrowing of existing achievement gaps (Loveless, 2012). If CCSS implementation is to be more than a superficial action in schools or districts—more than compliance to yet another initiative—and is instead intended to result in real improvements in student learning and to close achievement gaps, then implementation efforts need to be more about instruction—how teachers approach student learning of the content standards. As Wiliam contends, “Pedagogy trumps curriculum. Or more precisely, pedagogy is curriculum, because what matters is how things are taught, rather than what is taught” (2011, p. 13).

The CCSS for mathematics includes content standards for developing student understanding as well as standards for student proficiency in their mathematical learning experiences. In addition, “The Standards for Mathematical Practice describe varieties of
expertise that mathematics educators at all levels should seek to develop in their students” (NGA & CCSSO, 2010, p. 6). When students are engaged in the Standards for Mathematical Practice, they are making and evaluating their conjectures as part of meaningful discussions with their peers. This kind of involvement and depth of understanding requires that teachers teach for understanding in perhaps for some educators, a new manner and level of reasoning.

The ultimate goal of the CCSS is to provide opportunities for students to be armed with knowledge and understanding that will help them succeed in doing and using mathematics not only across K-12 mathematics curriculum but beyond PreK-12 and also in their college and career work. College instructors regard the Mathematical Practices as being of higher value for students to master in order to succeed in their courses than any of the CCSS content standards. This valuation is true for mathematics, language, science, and social studies college instructors (Conley, Drummond, de Gonzales, Rooseboom, & Stout, 2011).

Research indicates that mathematics learning should go beyond demonstration of procedural content; it should include opportunities for students to reason and make sense of the mathematics they are learning. Specifically, the Standards for Mathematical Practice are built on NCTM’s work (2000, 2006, 2009), in particular NCTM’s emphasis on process standards in addition to content. Furthermore, the National Research Council (NRC, 2001) defines mathematics learning and proficiency as consisting of much more than procedural knowledge. NCTM’s and NRC’s groundwork is reinforced and further refined in the CCSS Mathematical Practices.

The first of these works are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the NRC’s report *Adding It Up*: adaptive reasoning,
strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one’s own efficacy) (CCSSI, 2010).

The Standards for Mathematical Practice

The eight Standards for Mathematical Practice “describe varieties of expertise that mathematics educators at all levels should seek to develop in their students” (CCSSI, 2010, p. 6). These practices describe processes that students are expected to develop and apply in the mathematics classrooms. The Standards for Mathematical Practice are central to mathematics lessons and are identified, managed in a grade-appropriate way, and well connected to the content standards being addressed. Mathematically proficient students:

• Make sense of problems and persevere in solving them.
• Reason abstractly and quantitatively.
• Construct viable arguments and critique the reasoning of others
• Model with mathematics.
• Use appropriate tools strategically.
• Attend to precision.
• Look for and make use of structure.
• Look for and express regularity in repeated reasoning (CCSSI, 2010, pp. 6-8).

The CCSS Mathematical Practices describe what students should be doing as they learn the CCSS for mathematics content standards. How should students engage with that mathematics and interact with their fellow students? By creating a classroom culture that
extends beyond traditional, teacher-centered instruction, teachers can successfully facilitate students’ engagement in mathematics learning that leads to proficiency in the Standards for Mathematics Practice. The Standards for Mathematical Practice are not a checklist of teacher to-dos, but rather, they support an environment in which the CCSS for mathematics content standards are enacted and are framed by specific expertise that teachers can use to help students develop to support their understanding and applications of mathematics.

Boykin and Noguera contend that the direct teaching of and regular practice with the instructional strategies such as those expected in the CCSS Mathematical Practices (for example, ensuring opportunities for students to communicate, conjecture, and reason with peers) is rarely, if ever, done. They indicate, “this state of pedagogical affairs needs to be rectified” (2011, p. 25). They state further:

Gap closing results did not occur in classrooms that primarily manifested “basic skills” instruction (i.e., activities that require students to come up with yes or no responses that are either correct or incorrect). . . . One of the more actively researched areas for deep processing is referred to as cognitive elaboration. Here the focus is on going beyond “yes/no” or “true/false” answers, beyond bubbling in multiple-choice responses, and beyond providing simple names and dates for answers. Instead the focus is on enabling students to justify their answers, to provide more thoughtful and reflective answers, and to recognize their role as knowledge producers (2011, p. 126).

As teachers concentrate purposeful attention on implementing the CCSS Mathematical Practices, part of the problem for some educators may be to envision what the eight practices actually look like in the classroom as part of instruction. The student tasks teachers design, the questions they ask to check for understanding in the classroom, and the discussions in which students participate, will all combine to advance students’ abilities to engage with peers in the mathematical practices.

When providing mathematics instruction, teachers often avoid planning for and using problem-solving tasks and activities that challenge students to persevere. Several reasons exist,
according to results of the *TIMSS Videotape Classroom Study* (Stigler, Gonzales, Kawanka, Knoll, & Serrano, 1999), teachers’ beliefs about teaching and learning often lead them to “design lessons that remove obstacles and minimize confusion [where] procedures for solving problems would be clearly demonstrated so students would not flounder or struggle” (p. 137). Lessons planned from this perspective, that students need protection from constructive struggle, do not support the perseverance aspects of Mathematical Practice 1—“Make sense of problems and persevere in solving them” and Mathematical Practice 6—“Attend to precision” and deny students the opportunity to develop meaningful mathematical understandings (Stein, Remillard, & Smith, 2007).

**Common Core State Standards for Mathematics**

Cognitively demanding tasks are at the heart of the implementation of the Common Core Standards for Mathematics (CCSSI, 2010). Students will be required to examine a mathematical situation, find an entry point to begin their exploration, and apply their understanding of mathematical concepts to find and justify their solutions (Smith and Stein, 1998).

The Common Core State Standards for mathematics include standards for mathematics content as well as standards describing expectations for mathematical practice. According to the CCSS, “The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students” (NGA & CCSSO, 2010. p.6). Implementation of the Standards for Mathematical Practice addresses the required paradigm shift in different ways—in ways that focus on the process of learning and developing deep student understanding of the mathematical content. The goal for math educators in regards to CCSS will be to develop in students’ conceptual understanding and procedural fluency of the content through the collaborative selection of high-cognitive-demand mathematical tasks with a focus on
student engagement with the Mathematical Practices. First, and foremost, teachers need the time and space to study collaboratively with other teachers to be able to fulfill this goal.

The CCSSM are, at the same time, promising for students and potentially problematic for teachers. Educators, in general, hope that the adoption and implementation of CCSS can result in deeper, more coherent math instruction for all students. The Standards for Mathematical Practice focus on what it means to do the mathematics in the content standards. The integration of the Standards for Mathematics Content and the Standards for Mathematical Practice is one way to arrange CCSSM for ways in which its standards can serve all students.

A challenge of implementation is that the Standards for Mathematical Practice must be taken as serious as the Standards for Content in mathematics. Both sets of standards need to be focused with strategic, targeted, intentional, planned instruction. The mathematical practice standards in the classroom can be undermined by one-dimensional approaches that teachers think they are implementing all eight of the Practices all the time. If these practices are happening “all the time,” the result will be that none of them are happening with any attention or depth. Yet, from a math perspective, they should not be relegated to isolated teaching sessions apart from the core mathematical content.

What is in teachers’, districts’, states’ and the nation’s future as CCSSM is implemented? Will all students be supported to do the kind of significant mathematics learning? Problematic for some educators is that the CCSSM does not tell how to teach. Rather, it offers a framework that must be interpreted and implemented using all the knowledge about student’s varying learning needs and strengths. One way to do this is to take seriously the backbone of the CCSSM—the Standards for Mathematical Practice—and to weave them into the content at each grade level, with deliberation and focus, by developing an integrated package of both the Content
Standards and the Practice Standards. This approach has the potential to put mathematical
taking at the heart of the math lesson and to build, for all students, a solid, lasting mathematical
foundation. Teaching in the era of the CCSM requires both skepticism and courage.

**Purpose of the Study**

Today’s US education policy places a high priority on improving teacher quality and
teaching effectiveness in schools (Obama, 2009). Standards based professional learning requires
teachers to have deep subject knowledge and the most effective pedagogy for teaching the
subject. But getting teachers to the professional space where they possess both deep content and
effective pedagogy can be elusive.

The purpose of this single case study is to examine one professional development
implementation in the form of a professional learning collaborative structure—Whole Faculty
Study Groups—and then within that scheduled time and space provide training modules for a
team of third-, fourth-, and fifth-grade mathematics teachers to study the CCSS Standards for
Mathematical Practice. This study explores whether teachers who participate will have a better
understanding of the Standards for Mathematical Practice as they prepare to transition to the
CCSS in mathematics in the fall of the 2013-2014 school year. A secondary purpose will be to
determine if a Whole Faculty Study Group process for teacher collaboration could be a model for
statewide implementation of CCSS math standards.

**Setting**

A rural north Louisiana charter school was selected as the setting for this study because
there is a lack of research that examines what happens inside charter schools with respect to
instructional and curricular issues as a result of intensive professional development and no
research in rural Louisiana charter schools. Bellamy Charter School\textsuperscript{1}—a start-up charter school—is in its fourth year of an initial 5-year contract. According to the mission statement, the school is dedicated to providing ALL children with a meaningful and engaging educational experience. Each child's potential will be achieved by enabling him/her to read, write, participate and explore. The school opened its doors in the fall of 2009 with grades kindergarten through sixth grade in a temporary location that once served as the town’s skating rink and later a hardware store. The design of the school allowed for little extra space, limited technology access, walls that did not go all the way to the ceiling or floor and no classroom doors. In spite of these conditions, the 221 students managed to out-perform the students of the local school system in the 2010 spring high-stakes state testing after having been with the faculty and staff for only seven months before testing.

The school moved its location in the summer of 2010 to an abandoned Wal-Mart facility and managed to gain much needed space and growth inclusive of technology capabilities. Over the next two school years—2010-2011 and 2011-2012—the student population steadily grew to 302 students with the addition of grade seven and 364 students the following year with the addition of grade eight. In the 2012-2013 school year, the school added grade nine.

The school’s 2012-13 student population was 564 students with 261 females and 303 males, 78.5\% of those being Caucasian, 7.4\% African American, 10.2\% Hispanic, 2.3\% Asian, and 1.4\% Other. 58\% of students received free or reduced lunch. The school had 100\% of its teachers certified as highly qualified teachers.

\textsuperscript{1} The name of the school and the names of participants in this study have been changed to provide confidentiality.
Research Questions

In order to improve professional learning and determine its effectiveness in achieving the desired instructional outcomes, an evaluation process should be implemented. Guskey (2000) suggested several levels of evaluation to assess the strengths and weaknesses of professional learning, including: participants’ learning, participants’ use of new knowledge and skills, and student learning outcomes. Guskey suggested that when professional learning is successful, it is because teachers are supported and held accountable to use the new practices. Moreover, when teachers begin to see that the new practice works, more often than not, they eventually “practice themselves into change.” (2000, p.189)

For this study, the research questions were based on collaborative professional learning with a focus on participant’s perceived learning. I conducted the study to look at teachers’ understanding the most significant contributions of the Standards for Mathematical Practice because the Common Core math standards actually encompass two kinds of standards, the content standards and the Standards for Mathematical Practice. Since much of the professional development about the Common Core focuses on the content standards, the Standards for Mathematical Practice could easily be overlooked if not emphasized. I also wanted to find out whether job-embedded collaborative professional learning could increase teachers’ understanding of the importance of the Standards for Mathematical Practice and the selection of high-cognitive-demand mathematical tasks with a focus on student engagement with the Mathematical Practices. As noted in the literature review, there appears to be no research on developing teacher understanding of these math practice standards.
The overall guiding question of the research is: What impact has the professional learning from Whole-Faculty Study Group sessions had on teachers’ understanding the most significant contributions of the Standards for Mathematical Practice in preparation of the implementation of the Common Core State Standards in Mathematics?

Significance of Study

This study is important for its setting, its framework for the professional learning intervention, and its focus on the Common Core State Standards. The setting for this is important because the setting was a rural start-up charter school in north Louisiana. There has been very little research done on teaching and learning in charter schools in Louisiana and none on rural charter schools. Second, the framework for this professional learning intervention was the Whole Faculty Study Groups system for schoolwide teacher collaboration. A key focus of this study was whether teachers working collaboratively in a WFSG study group perceived the benefits of successful collaboration as they engaged together in the content. Third, this study is important because the content of the work was teachers developing an understanding of, and an appreciation for, the significance of the new Standards for Mathematical Practice in the Common Core State Standards in Mathematics. Case study research into how teachers learn about and use CCSSM content and practice standards is one of the priority case research areas identified by Horizon Research as part of a National Science Foundation funded project on the development of a research agenda for understanding the influence of the Common Core State Standards for Mathematics (Heck, Weiss, & Pasley, 2011, p. 14).

Definition of Terms

A number of terms were defined for the purposes of this study. These are:

Action Plan is a document completed by each Whole-Faculty Study Group at the
beginning of the collaboration process and can be revised and updated as needed. The action plan includes these components 1) general category of student needs, 2) the essential question that will guide the study group throughout its work, 3) actions teachers will take when the study group meets, 4) resources that study group will use, 5) the group’s norms, 6) assessment of evidence that the study group work is having an impact on targeted student needs by specifying a) specific student needs, b) data sources with evidence of improvement, c) baseline status of needs, and d) targeted and actual results at the end of a specified period (Murphy & Lick, 2005, p. 92).

**Collaboration** is a process that facilitates learning by providing practitioners of differentiated abilities opportunities to discuss debate, observe, and share practices (Lave & Wenger, 1991; Wenger, 1998; Levine & Marcus, 2010).

**Content knowledge** refers to knowledge of content. Shulman says that it goes beyond this. The teacher need not only understand *that* something is so; the teacher must further understand *why* it is so, on what grounds its warrant can be asserted, and under what circumstances our belief in its justification can be weakened and even denied (1986, p. 9). Thus, teachers must understand the organizing structure of their discipline and how the concepts are related.

**Job-Embedded Professional Development** is a form of professional development or learning that takes place during the course of one’s work, where daily access to necessary materials, knowledge, and assistance are readily available. Job-embedded activities can include professional learning communities (Wendell, 2010).

**Mathematical Proficiency** inclusive of the following five strands are 1) Conceptual understanding—comprehension of mathematical concepts, operations, and relations. 2)
Procedural fluency—skill in carrying out procedures flexibly, accurately, efficiently, and appropriately. 3) Strategic competence—ability to formulate, represent, and solve mathematical problems. 4) Adaptive reasoning—capacity for logical thought, reflection, explanation, and justification. 5) Productive disposition—habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one’s own efficacy (NRC, 2001).

**Pedagogical content knowledge** is subject matter knowledge for teaching. This entails making the subject accessible to students. It includes knowing the best representations of material, what makes the subject easy or difficult for students, and places where students commonly make mistakes. Pedagogical content knowledge provides a link between knowledge of teaching and knowledge of a subject, to give us a type of knowledge unique to the profession of teaching a specific content area (Shulman, 1986, p. 9).

**Procedural knowledge** consists of rules or procedures for solving mathematical problems. Many of the procedures that students possess probably are chains of prescriptions for manipulating symbols (Hiebert and Lefevre, 1986, p. 3).

**Professional Learning Communities (PLC)** are educators committed to working collaboratively in ongoing processes of collective inquiry and action research in order to achieve better results for the students they serve. PLCs operate under the assumption that the key to improved learning for students is continuous, job-embedded learning for educators (DuFour, DuFour, Eaker, Many. 2006).

**Standards for Mathematical Practice** with expected student learning outcomes are 1) Make sense of problems and persevere in solving them—students understand what they are being asked and consider multiple strategies and tools to analyze and solve problems. 2) Reason abstractly and quantitatively—students use mathematics in the abstract and are able to
symbolically represent quantities and their relationships—understanding the underlying meaning, not just how to compute. 3) Construct viable arguments and critique the reasoning of others—individually or in groups, students articulate and defend their ideas and analyze the reasoning of others. 4) Model with mathematics—students apply the mathematics they know to solve problems using tools such as diagrams, tables, graphs, and formulas to represent and analyze relationships and draw conclusions. 5) Use appropriate tools strategically—students consider available tools—including concrete models and technology—and use them strategically to solve mathematical problems. 6) Attend to precision—students are precise in their mathematical communication, use of terminology, and are careful about expressing numerical answers with a degree of precision appropriate for the problem context. 7) Look for and make use of structure—students look for and make use of pattern and structure in learning mathematics and solving problems. 8) Look for and express regularity in repeated reasoning—students notice repetitions in calculations and look for general methods and for shortcuts (Math Solutions, 2013).

Whole-Faculty Study Groups (WFSG) are a form of Professional Learning Communities. WFSG are a job-embedded, self-directed, student-driven approach to professional development. It is a professional development system designed to build communities of learners in which professionals continuously strive to improve schools and increase student learning. To improve schools and increase student learning, educators must deepen their own knowledge and understanding of what is taught, reflect on their practices, sharpen their skills, and take joint responsibility for the students they teach (Lick & Murphy, 2007). Every faculty member at the school is a member of a study group of three to five individuals focusing on data-driven student
instructional needs and working collaboratively to increase their capacities to enable their students to reach higher levels of performance (Clauset et al., 2008, p. 8).

In order to fully understand the framework the study will employ and the research questions chosen, chapter two presents literature pertinent to job-embedded professional development, teacher collaboration teams and WFSG, charter schools, and standards-based mathematics teaching. Chapter three discusses the overall research plan utilized to address the main research question of this study: What impact has the professional learning from Whole Faculty Study Group sessions had on teachers’ understanding the most significant contributions of the Standards for Mathematical Practice in preparation of the implementation of the Common Core State Standards for mathematics?
CHAPTER 2: REVIEW OF LITERATURE

Introduction

Schools in the United States are under increasing pressure to achieve student outcomes at a higher rate than they have ever before produced. The NCLB Act (2002) set a goal of 100 percent proficiency by 2014; however, legislation is not the only source of pressure. In an era of computers and instant access to information, problem solving, teamwork, and communication skills are essential for personal and national success. The challenge is that we are asking schools to do something they have never been accountable for before—educate all students to high levels—and we don’t know how to do that in every classroom for every child. There are pockets of excellence throughout US and Louisiana schools and school systems. A piece of the challenge is to bring those pockets of excellence to scale—to provide for all what our systems currently provide for some (Elmore, et al., 2010).

In the United States, we have more variation in student achievement than do almost all of our international peers and it matters tremendously in which classroom students are enrolled (McKinsey & Co, 2009). This is no surprise, given the traditional teaching norms of autonomy and isolation. Based on this educator’s experience over twenty-seven years, it is clear that closed classroom doors will not help us educate all students to high levels. It is also clear that what happens in classrooms matter for student learning and that educators can do more together than teachers can do individually to improve learning and teaching. However, not all forms of professional development and collaboration are created equal. Slowly, the image of the teacher behind the closed classroom door is giving way to an image of an open door, but many educators are not sure what to look for when they open the door and to do with what they see (Elmore, et al., 2010).
April 2013 marked the 30th anniversary of “A Nation at Risk,” (US Department of Education, 1983) the controversial report from the National Commission on Excellence in Education, that detailed the extreme conditions of the US public education system and called for government reform. Little has changed today, according to a February 2013 report, “For each and Every Child” from the US Department of Education’s Equity and Excellence Commission. And this is despite the changes that numerous educators, scholars, policy makers, and politicians have pressed for in three decades under the term of education reform. According to some measures, US students still fall behind nations including Taiwan, Finland, and Singapore on international assessments, and US schools, especially in urban and rural areas, continuously have a difficult time attracting high-quality teachers. Further, the report states, the US education system is more segregated by wealth, income, and race than ever, leaving the poorest student with the least prepared and often lowest-performing teachers, most run-down facilities and infrastructures, and lower academic expectations and opportunities than their middle- and upper-class peers (DeNisco, 2013).

Despite such bleak statistics, some progress has been made: elementary-level reading and math performance improved in recent years, as has middle-school math. However, in most states, these improvements pale in comparison to the large rise of other nations to improve and strengthen their education systems. Looking to the future, the implementation of the CCSS is expected to help close the achievement gap by holding states accountable for preparing students for college and the workforce (CCSSI, 2010).

Louisiana is one of the 45 states that have adopted the CCSS along with the District of Columbia, four territories, and the Department of Defense Education Activity. The CCSS mission statement elicits that “the Common Core State Standards provide a consistent, clear
understanding of what students are expected to learn, so teachers and parents know what they need to do to help them. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that our young people need for success in college and careers. With American students fully prepared for the future, our communities will be best positioned to compete successfully in the global economy” (CCSSI, 2010).

Today’s US education policy places a high priority on improving teacher quality and teaching effectiveness in schools (Obama, 2009). Standards-based professional learning requires teachers to have deep subject knowledge and the most effective pedagogical practices for teaching the subject. States and school districts are charged with establishing teacher professional development programs, some with federal funding support, designed to address the significant needs for improved teacher practice.

School improvement and increasing student achievement are the two most critical issues in education today (Clauset et al., 2008). School districts have been searching for ways to change the culture of the school, increase student learning, and improve schools through job-embedded professional development in an ever-changing world with increasing expectations and demands.

This review of literature addresses job-embedded professional development, job-embedded teacher collaboration teams, charter schools, and standards-based mathematics teaching. These four areas are the focus of the literature review because

- The setting for this study was a rural Louisiana charter school,
- The intervention was job-embedded professional development,
- Teachers were expected to work in a job-embedded teacher collaboration team, and
The content for the professional development was the Common Core Standards for Mathematical Practice.

Charter Schools

After decades of essentially flat performance, the problems associated with designing, implementing and assessing education reform initiatives are evident; most attempts to date have not been successful. Increasingly, the list of strategies includes identifying successful high-quality schools and encouraging their replication. In forty-three states, that approach focuses on charter schools -- public schools that are given a fixed-term contract with wider operating discretion than typical public schools and more definite performance review at the end of their term (Center for Research on Educational Outcomes, 2013).

In the United States, charter schools are public schools that are granted a charter by individual state entities or local boards. These entities generally allow greater autonomy over curricular issues, instruction, and human resource operations than traditional public schools (Zimmer et al., 2009). During the 2012-13 school year, approximately two million students were enrolled in more than 5,500 charter schools in the United States (National Alliance for Public Charter Schools, 2012). In the current political context, there is support of continued expansion of charter schools (US Department of Education, 2009). Differences exist between state charter laws and states’ policies fluctuate widely, however, within this charter context, schools, including the principals that lead them, are expected to be innovative in order to improve student achievement (Lubienski & Weitzel, 2010).

Although Louisiana has five distinct charter school types, charter schools in the state tend to be of two general types, start-up charters, often referred to as choice charters, or a conversion charter schools which are typically called take over charter schools. Generally, start-up charters
begin with an explicit purpose or focus; they recruit students, and are considered schools of choice. Conversely, conversion schools are usually existing schools which are converted to charters, in most instances using the same school facility and which tend to enroll students that previously attended the school prior to take over or conversion (California Charter Schools Association, 2012). Depending on state law, these conversion schools are required to convert because of consistently low student performance and as a result, are labeled take-over schools.

Charter schools in Louisiana must enroll any student who applies as long as the school has space. If demand exceeds available space, charter schools must conduct a lottery to determine student enrollment. Students in Louisiana charter schools must take the same assessments as students in district-run public schools and charter schools are graded, just like public schools, on a scale of A – F.

In Louisiana, 104 charter schools are educating nearly 58,000 students. An additional 11 charter schools opened in the 2012-2013 school year. From 2011 to 2012, charter schools outpaced district schools in raising student achievement, gaining an average of 6.14 points compared to 4.7 points for district-run schools (Louisiana Department of Education, 2013a).

Given the difficulties many districts face in terms of providing professional development regarding the CCSS, providing professional development in rural areas, often isolated by distance, can be particularly difficult. Charter schools typically operate without the supports generally found in districts (Campbell & Gross, 2008; National Alliance for Public Charter Schools, 2008), therefore in a rural charter school, providing professional development can be an acute challenge
The research of charter schools is sparse, with mixed results related to effectiveness and with much of the existing research focused on policy and governance issues (Lubienski & Weitzel, 2010). There is a lack of research that examines what happens inside charter schools with respect to instructional and curricular issues as a result of intensive professional development (Berends, Goldring, Stein, & Cravens, 2010; Center on Reinventing Public Education, 2007; Gross, 2011; Merseth, 2009), and much of the existing research focuses on urban charter schools.

There appears to be only one study that focused on the inner workings of Louisiana charter schools, and this study examined the use of time by urban charter school principals (Bickmore & Sulentic Dowell, 2011). The absence of research in a rural Louisiana charter schools points to the timeliness of this study.

**Job-Embedded Professional Development**

Teachers working collaboratively in job-embedded teams have emerged as a viable form of professional development. No Child Left Behind (NCLB, 2002) and state accountability legislation have had a profound impact on professional development. “Two aspects of NCLB legislation have special significances for staff development leaders. First is the requirement for ‘scientific, research-based programs.’ Second is the strong emphasis on accountability, defined in terms of improvements in student performance” (Guskey, 2003, p. 27).

In 2007, the Council of Chief State School Officers (CCSSO) undertook a meta-analysis study of the effects of teacher professional learning on raising student achievement (Blank & de las Alas, 2009). The 16 studies identified through the meta-analysis provide important findings about the design and implementation of professional learning that has a significant effect on improving student achievement. The studies showed significant gains in student achievement
either using a design that compared outcomes for teachers in a treatment group to students of comparable teachers and classes in a control group (treatment-control design) or a design that measured student gains and improvement in student achievement in comparison to prior achievement (pre-post design) (Blank & de las Alas, 2009).

A review and analysis of the characteristics of professional learning teachers received in these 16 projects find a number of common elements. These common elements of effective professional learning are consistent across almost all of the programs (Blank & de las Alas, 2009, pp. 19-20). Common elements of effective programs have a significantly better chance to improve teacher skills and knowledge and, subsequently, raise student achievement:

- Content focus.
- More time (contact hours) for professional learning.
- Longer duration of professional learning.
- Multiple professional learning activities and active learning methods.
- Learning goals in professional learning design.
- Collective participation by teachers.

Teachers consider professional development applicable when it directly addresses their specific needs and concerns (Guskey, 1995), or when they see a connection between a learning experience and their daily responsibilities (Flores, 2005; Tate, 2009). Under the best circumstances, teacher learning is validated through seamless integration into each school day (Fullan, 1995). Professional development within the context of the school, such as [instructional] coaching, mentoring, and study groups, promotes active learning and builds coherence more than traditional learning venues (Quick, Holtzman, & Chaney, 2009).
Described below are three salient elements that highlight the wide-range of formats for job-embedded professional development:

- Instructional coaches are onsite professional developers who teach educators how to use proven teaching methods. They employ a variety of professional development procedures to foster widespread, high-quality implementation of interventions, providing “on-the-job learning” (Knight, 2007).
- Mentoring is increasingly implemented as part of the induction phase for new teachers, mentoring may develop into coaching or peer support relationships as teachers gain experience. Best practice includes matching teachers of the same content area, establishing common planning time, and structuring time for further collaboration (Croft et al., 2010).
- Study groups are small groups or as a faculty, teachers generate topics for study related to school improvement goals or student data and then read and react to educational research or other literature on teaching and student learning. They engage in structured dialogue or discussion that explores issues deeply and considers implications for school or classroom practices (Croft et al., 2010). These are also referred to as “job-embedded teacher collaboration teams” which is the focus of the next section of this review.

In other words, job-embedded professional development engages teachers in learning through their daily activities and responsibilities, and is embedded versus separate from teachers’ daily concerns. Job-embedded professional development requires that teachers take time to consider possibilities, try out new ideas, and analyze the effectiveness of their actions. Even when professional development takes the form of a more traditional inservice or workshop, follow up activities such as job-embedded projects or action research increase teachers’
perceptions of relevance and authenticity which in turn supports professional learning (Tate, 2009).

Rigorous research suggests that sustained and intensive professional learning for teachers is correlated to student-achievement gains. An analysis of well designed experimental studies found that a set of programs which offered substantial contact hours of professional development (ranging from 30 to 100 hours in total) spread over six to 12 months showed a positive and significant effect on student achievement gains. According to the research, these intensive professional development efforts that offered an average of 49 hours in a year boosted student achievement by approximately 21 percentile points (Yoon et al., 2007). Other efforts that involved a limited amount of professional development (ranging from 5 to 14 hours in total) showed no statistically significant effect on student learning (Yoon et al., 2007). These findings substantiate the importance of making time (i.e., released time, restructured or rescheduled time, common time, and purchased time) for sustained job-embedded professional development opportunities (Darling-Hammond, 2000; Guskey, 1999; Murphy & Lick, 2001; Wei et al., 2009; WestEd, 2000; Yoon et al., 2007). Therefore, not having enough time built into a school’s calendar and schedule is a major barrier to effective job-embedded professional development.

Learning Forward’s Standards for Professional Learning—Learning Communities

The earlier standards for staff development from the NSDC (2001) (now called Learning Forward) included separate standards for Collaboration and Learning Communities. Both emphasized the process and structure of learning collaboratively. For example, the 2001 Learning Communities standard stated, “Staff development that improves the learning of all students organizes adults into learning communities whose goals are aligned with those of the school and district” (NSDC 2001). And the 2001 Collaboration standard stated, “Staff development that improves the learning of all students provides educators with the knowledge
and skills to collaborate.” The 2011 standard for Learning Communities states, “Professional learning that increases educator effectiveness and results for all students occurs within learning communities committed to continuous improvement, collective responsibility, and goal alignment” (Learning Forward, 2011). The section of the standard on collective responsibility specifically addresses the importance of collaboration. These standards demand a new mode of educator learning. The decision to call these Standards for Professional Learning (Learning Forward, 2011) rather than Standards for Professional Development (NSDC, 2001) signals the significance of educators taking an involved role in their continuous development and places emphasis on their learning.

The following core elements for Learning Forward’s standard for Learning Communities are: (a) Engage in continuous improvement, (b) Develop collective responsibility, and (c) Create alignment and accountability (2011, pp. 24-26). Within the standard,

Learning communities apply a cycle of continuous improvement to engage in inquiry, action research, data analysis, planning, implementation, reflection, and evaluation. Characteristics of each application of the cycle of continuous improvement are: 1) The use of data to determine student and educator learning needs; 2) Identification of shared goals for student and educator learning; 3) Professional learning to extend educators' knowledge of content, content-specific pedagogy, how students learn, and management of classroom environments; 4) Selection and implementation of appropriate evidence-based strategies to achieve student and educator learning goals; 5) Application of the learning with local support at the work site; 6) Use of evidence to monitor and refine implementation; and 7) Evaluation of results (Learning Forward, 2011, p. 24).

Leadership

In A Playbook for Professional Learning: Putting the Standards into Action, Hirsch and Hord (2012) address the role of leaders as advocates for creating the right conditions for high-quality professional learning. They argue that

Leaders are responsible for communicating the importance of professional learning and advocating for it for all educators. They engage with stakeholders at all levels within and outside the organization to discuss the importance of investing in professional learning
and to describe the connection between professional learning and the system’s goals for staff and students. (Hirsch & Hord, 2012, pp. 47-48).

According to Hirsh and Hord, discussions regarding the importance of high-quality professional learning must include establishing a link between professional learning and student learning (2012). In addition to linking teacher learning to student learning, Rick and Becky DuFour’s four critical questions for student learning are key in guiding a framework for professional learning: (a) What do we want our students to learn?, (b) How will we know they are learning?, (c) How will we respond when they don’t learn?, and (d) How will we respond when they do learn? (DuFour & DuFour, 2007).

Successful leaders are those who “establish regular colleague-based learning teams . . . (and) . . . advocate for the importance of teacher perspective and voice in the decision-making process” (Hord & Hirsch, 2012, pp. 47-48). Research demonstrates that affecting deep change in teacher practice requires multiple types of learning designs, “observation, practice, and feedback,” and learning in social settings (Hirsch & Hord, 2012, pp. 126-127). Therefore, a school principal needs to be the kind of leader who facilitates deep professional development experiences. Learning Forward (2011, p. 28) supports this view of leaders deeply invested in their own professional learning as well as of the staff they lead. Its standard for leadership states “Professional learning that increases educator effectiveness and results for all students requires skillful leaders who develop capacity, advocate, and create support systems for professional learning.”

With leadership, teachers within a school can achieve deep content, make sense of problems and persevere, reason abstractly and quantitatively, construct viable arguments and critique the reasoning of others, model with mathematics, use appropriate tools strategically, attend to precision, look for and make use of structure, and look for and express regularity in
repeated reasoning. A deeper understanding of the eight mathematical practices will enable the teachers and leaders to envision what it means for the students to be mathematically proficient. The Standards for Mathematical Practice are actually the heart and soul of the Common Core State Standards in Mathematics.

**Job-Embedded Teacher Collaboration Teams**

Standards based professional learning requires teachers to have deep subject knowledge and effective pedagogical skill for teaching any subject. Job-embedded teacher collaboration teams are the vehicles for accomplishing this goal. Job-embedded teacher collaboration teams are currently known by many names, some of them trademarked, but all centered on themes of sustainable professional development, shared decision-making, action research, and teacher collaboration and team building. Job-embedded teacher collaboration teams in the literature are referred to by a myriad of terms such as “Whole-Faculty Study Groups (WFSG)” (Murphy and Lick, 1998; 2001; 2005; Lick & Murphy, 2007), “Professional Learning Communities (PLC)” (DuFour and Eaker, 1998; DuFour, Eaker, and DuFour, 2002), “Teacher Action Research Groups,” “Action Research Collaboratives,” and “PLTs,” as well as “Learning Teams” and many other permutations of the words professional, action research, learning, groups, and communities.

The PLC concept can best be defined as:

A professional learning community is made up of team members who regularly collaborate toward continued improvement in meeting learner needs through a shared curricular-focused vision. Facilitating this effort are the following tenets:

- Supportive leadership and structural conditions,
- Collective challenging, questioning, and reflecting on team-designed lessons and instructional practices/experiences, and
- Team decisions on essential learning outcomes and intervention/enrichment activities based on results of common formative student assessments (Reichstetter, 2006).
Across the United States, school districts are adopting job-embedded teacher collaboration teams as a strategy to increase student achievement by creating a collaborative school culture focused on learning. Proponents of reform and professional organizations have endorsed the concept of PLCs. For example, Learning Forward, formerly the National Staff Development Council (NSDC) the organization that created the Standards for Professional Learning (2011), has included learning communities as one of the organization’s Standards for Staff Development suggesting that PLCs are recognized as a strategy for school improvement, specifically job-embedded professional development.

In order for a job-embedded teacher collaboration team or PLC to function correctly, the teachers involved have to understand not only how it would affect their teaching styles, but also how it could improve their students' learning. Graham (2007) explained that once teachers’ minds moved from how it would affect their teaching styles and practices to how it would affect and improve the students' learning, the process of building a successfully functioning PLC could move forward. DuFour (2011) stated that a PLC will work best when the group has a common bond. The common bond may be that a group of teachers are all involved in the same portion of curriculum. It may be a group of teachers working across the curriculum to improve the overall curriculum for the same group of students.

The concept of PLC seems to have emerged from a variety of sources. At one level, it is connected with notions of inquiry, reflection and self-evaluating schools. In this respect the idea of an effective PLC is not new; certain key features were evident in the work of education writers in the early part of the last century. For example, Dewey was committed to the view that: “...educational practices provide the data, the subject matter, which forms the problems of inquiry” (1929, p. 33).
A generation ago, Stenhouse (1975) argued that teachers ought to be school and classroom researchers and play an active part in the curriculum development process. Schön (1983) was influential in advocating the notion of the ‘reflective practitioner.’ From the school-based curriculum development movement of the 1970s, a series of projects and activities emerged on the ‘thinking school’, ‘problem-solving school’ (Bolam, 1977) and, perhaps most notably, ‘creative school’ (CERI, 1978). Later, in the 1980s, came the shift to the self-reviewing or self-evaluating school (e.g. McMahon, Bolam, Abbott & Holly, 1984).

The actual term ‘PLC’ appears to be one emerging from those working within the profession and those supporting schools, for example, a research review for practitioners by Hord (1997). Most references to ‘learning community’ are related to learning through community service. ‘Professional community’ by contrast, is a body of research starting in the 1980s largely concerned with schools and departments as mediating contexts for teaching (Louis, Kruse & Bryk, 1995; Talbert, McLaughlin & Rowan, 1993):

... teachers’ responses to today’s students and notions of good teaching practice are heavily mediated by the character of the professional communities in which they work ... schools differed strikingly from one another in the strength of their professional community reporting clear differences, even within the same districts, in levels of collegiality, faculty innovativeness, and learning opportunities as perceived by teachers (McLaughlin & Talbert, 1993, p. 8).

In developing their framework for professional community, Louis and colleagues (Louis, Kruse & Bryk, 1995, p. 4) explained that they used the term: “... to emphasize our belief that unless teachers are provided with more supporting and engaging work environments, they cannot be expected to concentrate on increasing their abilities to reach and teach today’s students more effectively.” Seashore, Anderson, & Riedel elaborate:

By using the term professional learning community we signify our interest not only in discrete acts of teacher sharing, but in the establishment of a school-wide culture that makes collaboration expected, inclusive, genuine, ongoing, and focused on critically examining practice to improve student outcomes. ...The hypothesis is that what teachers
Job-embedded teacher collaboration teams or learning communities are moving beyond their adolescent years, as evidence provides the evolution in education literature, in practice, and in the Learning Forward Standards for Professional Learning (2011, p. 3).

It is not insignificant that the word ‘learning’ appears between ‘professional’ and ‘communities.’ Many schools throughout the United States refer to being a professional learning community. There are some schools that do none of the things that PLCs do. Conversely, there are school faculties that could serve as model PLC sites that never reference the term. A school becomes a professional learning community only when the educators within it align their practices with PLC concepts (DuFour, 2007). PLC concepts include that school staff must: 1) focus on learning rather than teaching, 2) work collaboratively on matters related to learning, and 3) hold itself accountable for the kind of results that fuel continual improvement (DuFour, 2007).

When educators do the hard work necessary to implement these concepts, their collective ability to help all students learn inevitably will rise. As the school moves forward, every professional in the building must engage with colleagues in the ongoing exploration of three critical questions that drive the work of those within a professional learning community:

1. What do we want each student to learn?
2. How will we know when each student has learned it?
3. How will we respond when a student experiences difficulty in learning? (DuFour et al., 2004)

DuFour (2011) reports that scholars such as Hattie (2009) and Barber and Moursed (2009) have found that professional learning communities hold the best promise for sustaining school improvement efforts. He writes
A study of the best school systems in the world found that schools in those systems focused on providing the “high-quality, collaborative, job-focused professional development” characteristic of “professional learning communities” in which teachers work together to help each other improve classroom practice (Barber and Moursched, 2009, p. 30).

The most comprehensive study of factors affecting schooling ever conducted concluded that the most powerful strategy for helping students learn at higher levels was ensuring that teachers work collaboratively in teams to establish the essential learnings all students must acquire, to gather evidence of student learning through an ongoing assessment process, and to use the evidence of student learning to discuss, evaluate, plan, and improve their instruction (Hattie, 2009).

The caution in these reports is that the efforts associated with nurturing professional learning communities will lack results if the principal lacks the clarity of what a school as a professional learning community is, and what is required for a school to become one.

Two leading groups of authors help to compare and contrast job-embedded teacher collaboration models. One best practice model is Rick and Becky DuFour’s Professional Learning Communities at Work, which targets embedding teacher professional collaboration for learning along with student intervention into a school’s scheduled activities. A second best practice model is Carlene Murphy’s Whole-Faculty Study Groups, which is the heart of a job-embedded, self-directed, student driven professional development system where the individual study groups (WFSGs) are professional learning communities that strive to increase student learning by engaging in cycles of action research driven by data and putting into practice what teachers have learned to do.

Professional Learning Communities at Work Model

Despite recent implementation models, education researchers have used the term “professional learning community” since the 1960’s to describe a more collaborative and collegial approach to teaching than the traditional isolated, closed-classroom-door model. In the late 1980’s and early 1990’s, the term began to be more specifically identified with practices
such as established shared norms and beliefs, and solving problems collaboratively. Today, the term is widely used to describe a broad range of different programs and practices, including in-person and online communities where educators connect to share tips and best practices.

McLester (2012), describes the DuFours’ PLC at Work model. The PLC work requires for each unit of instruction, teachers agree on the essential skills each student will learn, how much time they will devote to each, and what the assessment process will be for gathering evidence of student learning. Once they have evidence, they identify students who were not successful, discuss what may have caused the difficulties, and share strategies from teachers who successfully taught the unit. If the entire team finds that all their students were unsuccessful, they seek resources for learning how to teach the concepts better. The team also discusses strategies for enriching and extending learning for students who have demonstrated high proficiency. The DuFours’ PLC at Work model, centers on three big ideas that are core to transforming education practices.

The first big idea is to ensure that all students learn. Traditionally, students are taught and expected to learn, but with PLC at Work, the focus shifts from teaching to learning. Rather than leaving the treatment of struggling students up to individual teachers, who may deal with them in vastly different ways, the school implements a uniform policy for intervening with students.

The second big idea is to establish a culture of collaboration among staff. It goes against the grain in traditional education settings for teachers to open their classroom doors to share materials, ideas, strategies and results with each other, but this activity is at the core of PLC at Work.
The third and final big idea is a focus on results. In traditional classrooms, averages are often used to analyze student performance, and students not mastering skills are often left behind as a teacher proceeds to the next concept. With the PLC at Work model, data analysis focuses on the progress of each individual student, looking at specific percentage improvements and sharing strategies around how to maximize strengths and overcome weaknesses.

Schools implementing PLC at Work begin by establishing consensus on answers to three key questions: What do we want each student to learn? How will we know when each student has learned it? How will we respond when a student experiences difficulty in learning?

The Whole-Faculty Study Groups Model

In December 1986, Carlene Murphy, Joseph Murphy, Bruce Joyce, and Beverly Showers had their first conversation about how to increase student achievement through staff development in the Richmond County School District in Augusta, Georgia. This conversation led to a three-year working relationship and an intense focus on the culture of the school and the process of innovation, the ways teachers learn new teaching strategies, and the ways teachers transfer new skills into the classroom (Murphy & Lick, 2001).

One of their first decisions was that the work would involve whole schools. The program would be offered to whole faculties. This understanding, whole-faculty participation, became in later years the central feature of what is today called the Whole-Faculty Study Groups (WFSG) approach. Student results over a period of time showed an increase in achievement and a decrease in disruptive behavior (Joyce, Murphy, Showers, & Murphy, 1989; Murphy & Lick, 2005).

The WFSG approach is not the same as the work that began in Augusta in 1986. Elements have been added to the original design and others deleted. Even so, the heart of the work resides in the genius of Bruce Joyce and Beverly Showers and the work that was done in
Augusta. The work in Georgia focused on creating a structure to ensure that what teachers learned about Models of Teaching in summer staff development actually translated into teachers using these models proficiently in classes with students. When Carlene Murphy retired from Augusta and went national, she adapted the design in Augusta to disconnect the structure from Models of Teaching. Since leaving the Augusta project in 1990, Joyce and Showers have not been involved with Murphy in her WFSG work. The full title given to the work is Murphy’s Whole-Faculty Study Groups (Murphy & Lick, 2001).

The Whole-Faculty Study Group approach is a process aimed at changing schools. It enables teachers to design their own learning agenda and implement their findings for the benefit of their students, themselves, and the school. The process involves the “whole faculty” being committed to and involved in study groups, with each group having particular responsibility for a valuable change effort. In study groups that contain 3-5 members, all faculty in the school are members of study groups. Teachers participating in these study groups generally gain self-confidence and feel confirmed that their craft is based on a professional field of knowledge (Murphy & Lick, 1998, 2001, 2005).

As previously discussed, Whole-Faculty Study Groups: Creating professional learning communities that target student learning, the model by Carlene U. Murphy and Dale W. Lick (2005), which details the WFSG System, when implemented as designed, is an effective research-based professional development design for bringing about instructional improvement in schools. As such, Learning Forward (formerly the National Staff Development Council) featured the WFSG system in its book, Powerful Designs for Professional Learning (1999). Adam Urbanski, director of the Teacher Union Reform Network (TURN), and Xochitl Perez Castillo, a research associate with TURN, in their chapter in the WFSG Fieldbook (2007, p. 47)
described the WFSG system as a model of good professional development that is "job-embedded, teacher-driven, and centered on the work of their current students.” They continue to say

(T)he Whole Faculty Study Group System is respectful of teachers’ expertise and experience, eminently grounded in teachers’ practical and pragmatic goals, and structured to promote genuine collegiality and collaboration among teachers. In short, it harnesses the collective wisdom of teachers and focuses it all on the academic interest of their own students. By doing so, it diminishes the isolation that is plagued teachers and makes their practice more public – thus also more accountable.

Roberts, in The Whole-Faculty Study Group Fieldbook: Lessons Learned and Best Practices From Classrooms, Districts, and Schools states, “The WFSG system includes a seven-step Decision-Making Cycle (DMC) that schools use to determine students needs at the school, how the study groups will be organized, and what they will do” (2007a, p. 229). Roberts (2007b) describes an actual school example of the WFSG system in action and illustrates the actual work of a study group that sought to improve students’ measurement skills and understanding: In Louisiana from 2000-2009, schools could apply for a grant for school improvement through a state initiative called the Learning-Intensive Networking Communities for Success—LINCS. The LINCS process was a whole-school reform initiative that focused on site-based professional development and required and supported common study time for teachers. The LINCS process established professional learning communities in the schools to develop a culture of high expectations and to strengthen teaching and learning. In the grant process, the major vehicle for local school improvement was provided through the implementation of Whole-Faculty Study Group (WFSG) System (Murphy & Lick, 2005). The LINCS schools used the WFSG model’s seven-step Decision-Making Cycle as detailed in Table 2.1.
Table 2.1
Steps in the decision making process for WFSG

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<thead>
<tr>
<th>Step</th>
<th>Description</th>
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<tr>
<td>Step 1</td>
<td>Collect and Analyze Data</td>
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<tr>
<td>Step 2</td>
<td>State Student Needs</td>
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<tr>
<td>Step 3</td>
<td>Categorize and Prioritize Student Needs</td>
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<tr>
<td>Step 4</td>
<td>Organize Study Groups</td>
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<tr>
<td>Step 5</td>
<td>Develop Action Plans</td>
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<tr>
<td>Step 6</td>
<td>Implement Study Group Process</td>
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<tr>
<td>Step 7</td>
<td>Evaluate Impact of Study Groups on Student Learning</td>
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</table>

The measurement study group used classroom assessment data to help the school improve student achievement in measurement on the end-of-the-year state assessment, which was one of the school-wide student needs. Roberts reports that among the key findings at the study school were:

- Student data must be kept in view all year.
- The focus throughout the school year was always powered by the needs of the students.
- Action plans were continuously an important part of the discussion.
- Examination of student work was reflected in a journal from the measurement group.
- Group members were able to chart the growth of students through an analysis of their work from the beginning to the end of the school year.
- Test scores were analyzed at the end of the year to summarize successes of the study group’s work, according to the documentation sources contained in group’s action plans.

In addition, two critical findings from both the focus school study and from other grant-recipent schools in the Learning Intensive Networking Communities for Success (LINCS) program were the following:

1. The Whole Faculty Study Group process leads to the empowerment of teachers, bringing about mathematics improvement according to the student needs.
2. The effective use of student data to identify student needs to improve student achievement has been the power behind school improvement efforts. (Roberts, 2007b, pp. 121-122)

Clauset, Lick & Murphy (2008) reported that there was no funded independent research prior to 2007 on the impact of the WFSG system on improving teacher practice and student learning other than the external evaluation research commissioned by the LINCS initiative to assess the impact of the initiative on teacher practice and student performance. The LINCS research showed that, from 2000 to 2007, the percentage of students in participating schools scoring basic and above in English language arts and mathematics increased on state assessments. In addition, participating teachers demonstrated increased capability to design and teach standards-based lessons and increased ability to prepare rigorous standards-based student assessments (Langlois, 2010).

There have been two doctoral dissertations that focused on the impact of the WFSG system on student learning. Clauset et al. (2008, p. 126) stated that one component of the Lasserre-Cortez dissertation (2006) found that a sample of 95 LINCS schools had significantly higher student growth scores in the 2004–2005 school year than did 70 non-LINCS schools (2006, p. 129). Wendell’s dissertation (2010) examined the impact of WFSG on student achievement and teacher practices in grades K-3 of a Nebraska school district using an analysis of DIBELS scores and responses from surveys and interviews. Wendell found that all student scores showed significant improvement from the first to the second testing with the exception of one assessment for third graders. There was no significant difference in scores between WFSG focusing on reading fluency and those groups not focusing on fluency (2010, p. 2).

The essence of the Whole-Faculty Study Group (as a form of job-embedded professional development) is found in one question: “What are our students learning and achieving as a result of what we are learning and doing in our study group?” (Lick & Murphy, 2007, p. 3). Standards
based professional learning requires teachers to have deep subject knowledge and effective pedagogical skill for teaching any subject. In the WFSG design, the faculty study groups are the vehicles for accomplishing this goal.

In summary, the attributes of professional learning communities gleaned from both the PLC at Work and the WFSG designs include: (1) shared values and vision (e.g., focus on student learning, high expectations for teachers and students, shared vision for teaching and learning); (b) shared and supportive leadership (e.g., nurturing school administrators, shared power and authority, broad based decision-making); (c) collective learning and application to practice (e.g., sharing information, seeking new knowledge and skills, working collaboratively); (d) shared personal practice, (e.g., peer observations, coaching, and mentoring); and (e) supportive conditions that encompass both relationships (e.g., trust and respect, risk taking) and structures (e.g., resources of time, money, people, and materials and communication) (Hord, 1997; Hord & Sommers, 2008).

While the positive effects of professional learning communities (job-embedded professional development) are found throughout the literature, drawbacks that inhibit their implementation do exist. The development of professional learning communities requires significant change for a traditional school (McLaughlin & Talbert, 2010). Oper and Pedder posit, “Creating systems, supports, and norms that encourage both individual and organizational learning and getting the balance between internal and external resources of learning are difficult for most schools” (2011, p. 392). Building professional learning communities that will bring about change in the classroom and thus student achievement is challenging due to the amount of work and time involved and the cultural changes that are necessary (Fullan, 2006).
Beyond the potential difficulties associated with developing a professional learning community, are the tremendous challenges associated in sustaining this innovation (Olivier & Hipp, 2010). Fullan (2006) aptly notes that a change will not be sustained if the district or other system levels do not actively support and foster it.

As Hargreaves summarizes in the forward section to *Leading Professional Learning Communities: Voices from Research and Practice* (Hord & Sommers, 2008):

Professional learning communities are now ubiquitous. Few educational leaders and decreasing numbers of teachers remain unaware of that professional learning communities are meant to be—communities of professionals caring for and working to improve student learning together, by engaging in continuous collective learning of their own (2008, p. ii).

Many job-embedded teacher collaboration teams are hybrid combinations of other, well-known designs such as WFSGs and PLCs. This is a reflection of individual schools, districts, or states adapting the most applicable characteristics and principles of large programs or theories to meet specific needs. Hybrid combinations may also reflect efforts to scale up such practices.

**The Need for Standards-Based Math Professional Development**

Mathematics instruction in the United States has a long history of confidence in standards and curriculum programs as the primary means to improve student achievement (Larson, 2009). However, reliance on standards and materials to improve student achievement has not resulted in dramatic improvements in student learning, and more importantly, it has not resulted in a narrowing of existing achievement gaps (Loveless, 2012).

Over the past several decades, math standards have emerged to guide educators in the overall goal of developing mathematically proficient students. The CCSSM can be best understood as part of this evolution instead of viewed as “yet another set of standards” (O’Connell & SanGiovanni, 2013). If CCSSM implementation is to be more than a superficial
action in schools or districts—more than a content standards mapping—more than compliance to yet another initiative—and is instead, intended to result in real improvements in student learning and to close achievement gaps, then implementation efforts need to be more about instruction—how teachers approach student learning of the content standards. As Wiliam contends, “Pedagogy trumps curriculum. Or more precisely, pedagogy is curriculum, because what matters is how things are taught, rather than what is taught” (2011, p. 13).

The CCSS for mathematics includes content standards for developing student understanding as well as standards for student proficiency in their mathematical learning experiences. Mathematically proficient students merge their knowledge of math content with their ability to apply that knowledge to solve problems, communicate math ideas, justify solutions, model math concepts and reason to make sense of mathematics. In addition, “The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students” (NGA & CCSSO, 2010, p. 6). When students are engaged in the Standards for Mathematical Practice, they are making and evaluating their conjectures as part of meaningful discussions with their peers. This kind of involvement and depth of understanding requires that teachers teach for understanding in, perhaps for some educators, a new manner and level of reasoning. The Practices advance students’ learning from knowledge to application. They bring rigor to math classrooms. No matter how much content is presented in math classrooms, students are not mathematically proficient without attention to these standards.

The ultimate goal of the CCSS is to provide opportunities for students to be armed with knowledge and understanding that will help them succeed in doing and using mathematics not only across K-12 mathematics curriculum but beyond Pre-K-12 and also in their college and
career work. When students experience mathematics through the mathematical practices, they have multiple opportunities to make sense of the ideas and to build a deeper understanding of the skills and concepts. Reflecting on these practices, and discovering ways to assimilate them into the teaching of content, ensures that students have optimal experiences in math classrooms and emerge with solid skills that are essential as they continue to explore mathematics at higher levels. College instructors regard the Mathematical Practices as being of higher value for students to master in order to succeed in their courses than any of the CCSS content standards. This valuation is true for mathematics, language, science, and social studies college instructors (Conley, Drummond, de Gonzales, Rooseboom, & Stout, 2011).

Research signifies that mathematics learning should go beyond demonstration of procedural content; it should include occasions for students to reason and make sense of the mathematics they are learning. Specifically, the Standards for Mathematical Practice are built on NCTM’s work (2000, 2006, 2009), in particular NCTM’s emphasis on process standards in addition to content. Furthermore, the National Research Council (NRC, 2001) defines mathematics learning and proficiency as consisting of much more than procedural knowledge. NCTM’s and NRC’s groundwork is reinforced and further refined in the CCSS Mathematical Practices.

The first of these products was the 2000 NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second was the strands of mathematical proficiency specified in the 2001 NRC’s report *Adding It Up*: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see
mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one’s own efficacy) (CCSSI, 2010, p. 6).

Since the Common Core content and practice standards in mathematics were only released in 2010, research into the implementation process for these standards and their impact on teacher practice and student learning is just beginning. In November 2011, Horizon Research prepared a report for a National Science Foundation funded project on the development of a research agenda for understanding the influence of the Common Core State Standards for Mathematics (Heck, Weiss, & Pasley, 2011). The report calls for case study research into how teachers learn about and use CCSSM content and practice standards, including what they see as the implications of CCSSM for their further professional learning, how they see the practice and content standards affecting their instruction over time, and what they use for curricular, instructional, and technological resources and why. (p. 14).

Summary

This review of literature addressed job-embedded professional development, job-embedded teacher collaboration teams, charter schools, and standards-based mathematics teaching. These four areas were the focus of the literature review because the setting for this study was a rural Louisiana charter school, the intervention was job-embedded professional development, teachers were expected to work in a job-embedded teacher collaboration team, and the content for the professional learning was the Common Core Standards for Mathematical Practice.

The review of the literature on charter schools found that there is a lack of research that examines what happens inside charter schools with respect to instructional and curricular issues as a result of intensive professional development and much of the existing research focuses on
urban charter schools. There appears to be only one study that focused on the inner workings of Louisiana charter schools, and this study examined the use of time by urban charter school principals. The absence of research in a rural Louisiana charter schools points to the timeliness of this study.

There is a growing literature on job-embedded professional development and Learning Forward, formerly the National Staff Development Council, released in 2011 its standards for professional learning. The standards state that effective professional learning occurs most often in learning communities; is supported with strong leadership and appropriate resources; is drawn from and measured by data on students, educators, and systems; applies appropriate designs for learning; has substantive implementation support; and focuses on student and educator standards. Rigorous research suggests that sustained and intensive professional learning for teachers is correlated to changes in teacher practice and to student-achievement gains.

Over the past twenty years there has been growing use of job-embedded teacher collaboration teams in schools. Designs for teacher collaboration teams include the DuFours’ PLCs at Work model and Murphy’s Whole Faculty Study Groups designs. Both designs include: (1) shared values and vision; (b) shared and supportive leadership; (c) collective learning and application to practice; (d) shared personal practice; and (e) supportive conditions that encompass both relationships and structures. Research has shown that the most powerful strategy for helping students learn at higher levels was ensuring that teachers work collaboratively in teams to improve their instruction.

The review of the literature on standards-based math professional development reveals that the Common Core content and practice standards have evolved from earlier efforts to
improve the quality of mathematics teaching and standards. Despite these reform efforts over the past two decades, there is a real risk that CCSSM implementation may be seen as a superficial, compliance action in schools or districts. To see real improvements in student learning and to close achievement gaps, implementation efforts need to be more about instruction—how teachers approach student learning of the content standards. This is the intent of the CCSSM Standards for Mathematical Practice that describe what it means to be mathematically proficient students from kindergarten to grade twelve. The review also indicates that there is a need for case study research into how teachers learn about and use CCSSM content and practice standards in their classrooms.

Chapter three describes the methodology used for a study in a rural elementary charter school in north Louisiana. It presents the rationale for a qualitative case study design and the theoretical framework used to design the professional learning intervention and the sampling of setting and participants. It enumerates the research questions and the rationale for these questions, delineates the data sources, intervention timeline and activities, data collection and analysis, the role of the researcher, and potential biases.

Chapter four presents the findings from this study organized around the four subordinate research questions and the overarching research question. Chapter five interprets the findings of the study presented in chapter four in the context of the literature review presented in chapter two, makes recommendations for future action, discusses the implications of this study, and suggests opportunities for further research.
CHAPTER 3: METHODOLOGY

The purpose of this single case qualitative study in a rural elementary charter school in north Louisiana was to examine one professional development implementation in the form of a professional learning collaborative structure—Whole Faculty Study Groups—and then within that scheduled time and space a team, or study group, of third-, fourth-, and fifth-grade mathematics teachers and two administrative leadership team members focused on the eight CCSS Standards for Mathematical Practice. This chapter describes the methodology used in this study.

**Rationale for a Qualitative Case Study Design**

Sturman (1997, p.61, as quoted in Bassey, 1999, p. 26) viewed a case study as a generic term used for the investigation of an individual, group or phenomenon. He further maintained that the techniques used in the investigation may be varied, and may include both qualitative and quantitative approaches. Merriam pointed out that: “a qualitative case study design is employed to gain an in-depth understanding of the situation and meaning for those involved. The interest is in the process rather than outcomes, in context rather than specific variable, in discovery rather than confirmation” (2001, p. 19).

“The overall purposes of qualitative research are to achieve an understanding of how people make sense out of their lives, delineate the process (rather than the outcome or product) of meaning-making, and describe how people interpret what they experience” (Merriam, 2001). Patton explains:

[Qualitative research] is an effort to understand situations in their uniqueness as part of a particular context and the interactions there. This understanding is an end in itself, so that it is not attempting to predict what may happen in the future necessarily, but to understand the nature of that setting—what it means for participants to be in that setting, what their lives are like, what’s going on for them, what their meanings are, what the
world looks like in that particular setting—and in the analysis to be able to communicate that faithfully to others who are interested in that setting. . . . The analysis strives for depth of understanding (1985, p. 1).

Further, O’Leary defined a case study as: “A method of studying elements of the social through comprehensive description and analysis of a single situation or case, for example, a detailed study of an individual, group, episode, event, or any other unit of social life organization” (2004, p. 85). This study sought to understand through qualitative research methods how one group of educators coalesces into a WFSG and gain content and pedagogical knowledge about the CCSSM.

**Theoretical Framework: Whole-Faculty Study Groups**

The framework used in the research study was the Whole Faculty Study Group (WFSG) process developed by Carlene Murphy. As previously discussed in the seminal text, *Whole-Faculty Study Groups: Creating professional learning communities that target student learning* by Carlene U. Murphy and Dale W. Lick (2005), the Whole-Faculty Study Group System, when properly applied, is one of the most effective research-based professional development designs for bringing about instructional improvement in schools. As such, the National Staff Development Council featured the WFSG system in its book, *Powerful Designs for Professional Learning* (1999).

Roberts (2007a, p. 229) in *The Whole-Faculty Study Group Fieldbook: Lessons Learned and Best Practices From Classrooms, Districts, and Schools* postulates, “The WFSG system includes a seven-step Decision-Making Cycle (DMC) that schools use to determine students needs at the school, how the study groups will be organized, and what they will do.” Roberts (2007a, p. 230) describes a brief overview that follows:

Within the WFSG format, distinct steps guide professional learning and development. The steps, addressed previously, but restated here for emphasis are highlighted in the
following sequence: Step 1 – Collect and Analyze Data; Step 2 – State Student Needs; Step 3 – Categorize and Prioritize student needs; Step 4 – Organize Study Groups; Step 5 – Develop Action Plans; Step 6 – Implement study group process, and Step 7 – Evaluate impact of study groups on student learning (Murphy, 2004).

Steps 1-4 are implemented with the whole faculty by a school team that has been trained in the WFSG process. This takes place at the beginning of the school year in a three-hour meeting.

In Step 5, each group develops an action plan. Action plans are usually completed in the first two meetings of study groups. By the end of September, study groups, typically, are in Step 6, implementing the action plans by doing in their study-group meetings what members indicated and committed to do in their action plan. Examples of study-group actions are: 1) design lessons, 2) practice teaching lessons, 3) model effective practices for peers, 4) examine and/or score student work, 5) discuss readings from professional journals, and 6) have a skillful person train the group in an effective strategy.

Step 7, the last step in the continuing cycle, is an ongoing assessment of the study group’s work throughout the school year to see its impact on student learning. In addition, at the end of the school year there is a meeting of the whole faculty to assess overall results and celebrate successes. During this Evaluative Summary meeting, each study group makes a presentation, describing its impact on student achievement.

The overarching question that guides study groups is this: What is happening differently in the classroom as a result of what teachers are doing and learning in study groups? With that vision, “study groups are motivated, work harder, and take responsibility for the successful implementation of required processes and procedures” (Murphy & Lick, 1998, p. 18). The benefits of the whole faculty working in study groups include the following 1) Improvement in the student needs areas that study groups target, 2) Culture shifts from isolation to collaboration, 3) Data being prominent in making instructional decisions, 4) Principals who are more instructionally focused, 5) New teachers who are in study groups surrounded by support, 6) Teachers seeing themselves as action researchers, 7) New instructional initiatives being implemented sooner and more thoroughly, 8) Multiple initiatives that are more coherent and integrated for maximum effects, 9) All teachers being viewed as leaders, 10) Behavioral norms for faculty becoming standard and 11) Looking at student work in collaborative settings
becoming the norm. Teachers take full responsibility for students represented in a study group (Lick & Murphy, 2007, p. 7).

For this study, the Whole-Faculty Study Group framework was utilized to provide a structure for the group’s meetings and to model teacher collaboration in a purpose-driven team or study group. Team members created a study group action plan and prepared meeting logs for each session. I, as a participant observer, facilitated the meetings. A schedule of the study group sessions was presented and group members established group norms as guidelines for the meetings. The deliberate organization of this collaborative group was three math teachers and two administrative leadership team members.

**Sampling of Setting and Participants**

Qualitative case study research is an understanding of an experience—teachers meeting collaboratively in job-embedded professional development (i.e., Whole-Faculty Study Groups); the researcher is the primary instrument in data collection and analysis (i.e., interviews, observations, etc.); and the rich-descriptive process describes the outcome. According to Creswell, “The idea behind qualitative research is to purposefully select participants or sites (or documents or visual material) that will best help the researcher understand the problem and the research question” (2009, p. 16).

In Patton’s view (2002), all types of sampling in qualitative research may be encompassed under the broad term of purposeful sampling. He states that “qualitative inquiry typically focuses in depth on relatively small samples, even single cases, selected purposefully” (p. 169). Patton (2002) describes 15 different strategies for purposefully selecting information-rich cases which may be listed as: extreme or deviant case sampling; intensity sampling; maximum variation sampling; homogeneous samples; typical case sampling; stratified
purposeful sampling; critical case sampling; snowball or chain sampling; criterion sampling; theory-based or operational construct sampling; confirming and disconfirming cases; opportunistic sampling; purposeful random sampling; sampling politically important cases and finally convenience sampling; what this illustrates is the complexity of sampling in qualitative research.

**Sampling for this Study**

For this study, I selected Bellamy Charter as the bounded case (Yin, 2009), which places limits within the time and place to secure a focus on the research questions and objectives. This case study is based on purposeful sampling which consists of both criterion and convenience sampling as outlined by Patton (2002) and the work of Collins, Onwuegbuzie, & Jiao (2007) who also discuss convenience and criterion sampling. Specifically, criterion sampling involves selecting cases that meet some predetermined criterion of importance (Patton, 2002, p. 238); the study school is a Charter School, which is a criterion sample. Another criterion is that all the teachers are highly qualified and certified. Convenience sampling, which involves a process of selecting subjects for examination and analysis that is based on accessibility, ease, speed, and low cost (Cohen & Crabtree 2006), was also used. I had easy access into this school based on personally knowing the Executive Director and understanding her wishes for a more structured teacher collaboration model at the school. The initial intent was to include the entire faculty in the study but to ensure the study remained reasonable in scope and that field data could be collected before the end of the 2012-13 school year, only one study group of five members and the executive director became the target participants.

In the WFSG approach to action research, the whole faculty is involved in study groups engaged in action research. Murphy and Lick explain the following:
By whole faculty, we mean all classroom teachers, all resource teachers, all special area teachers, librarians, counselors, and anyone else holding professional certification. Usually administrators will form a study group of administrators across the district. Some of the schools that have teaching assistants will include the assistants in the study groups with the professionally certified personnel; most however, will have study groups with only teaching assistants. In many schools, nonteaching personnel form study groups that focus on the role they have in supporting instruction (2004, pp.11-12).

As discussed above, when this study was originally proposed, I expected that the entire faculty, and all of the faculty study groups of one charter school would participate. However, the school did not launch schoolwide WFSGs in the spring as planned. Instead, a pilot study group composed of a 3rd, a 4th, and a 5th grade math teacher, and two administrative leadership team members was established. This team was the focus of this case study.

Use of Human Participants

A potential risk of this small study is the identification of individuals. A safeguard taken to protect the anonymity of the participants was to assign aliases to individuals and to the name of the school. Other precautions taken were to first obtain informed consent from participants of the study as a mechanism for ensuring that all understood what it meant to participate in this particular research study so they could decide in a conscious, deliberate way whether they wanted to participate. Secondly, informed consent was utilized as an important tool for ensuring respect for persons during the research. See Appendix D for the IRB Application that contains the research study interest form and the informed consent form.

Since this study documented the progress of a Whole-Faculty Study Group as perceived by five educators, the participants were not open to the elements of any treatment that could result in adverse consequences, nor was their welfare or rights threatened. Conversely, observation notes and the study group logs show that the participants benefitted from partaking in this study.
Setting

As discussed in chapter two, charter schools are publicly funded schools that are run independently of the school district. Charter schools are typically run by a not-for-profit organization governed by a board of directors comprised of parents, educators, and business leaders in the community. Charter schools operate with more autonomy than district-run schools in exchange for greater accountability. Charter schools are free for students and must enroll any student who applies as long as the school has space. If demand exceeds available space, charter schools usually conduct a lottery to determine student enrollment. Students in Louisiana charter schools must take the same assessments as students in district-run public schools and charter schools are graded, just like public schools, on a scale of A – F.

In Louisiana, 104 charter schools are educating nearly 58,000 students. An additional 11 charter schools opened in this current 2012-2013 school year. From 2011 to 2012, charter schools outpaced district schools in raising student achievement, gaining an average of 6.14 points compared to 4.7 points for district-run schools (Louisiana Department of Education, 2013a).

The setting for this study is a rural charter school in northeast Louisiana. Bellamy Charter School, a new start-up charter school, opened its doors in the fall of 2009 with grades kindergarten through sixth grade in a temporary location that once served as the town’s skating rink and later a hardware store. This charter is in its fourth year of an initial five-year contract.

The mission statement of Bellamy Charter School is dedicated to providing ALL children with a meaningful and engaging educational experience. Each child's potential will be achieved by enabling him/her to read, write, participate and explore. The original design of the school allowed for little extra space, limited technology access, walls that did not go all the way to the
ceiling or floor and no classroom doors. Despite of these conditions, the 221 students out-performed the students of the local school system in the 2010 spring high-stakes state testing after having been with the faculty and staff for only 7 months before testing. The school moved its location in the summer of 2010 to an abandoned Wal-Mart facility and managed to gain much needed space and growth inclusive of technology capabilities. The walls still did not go all the way to the ceiling but the construction of doors and additional floor space helped to improve the overall teaching conditions in the building. Over the next two school years—2010-2011 and 2011-2012—the student population steadily grew to 302 students with the addition of grade seven and 364 students the following year with the addition of grade eight.

The school has new board leadership and a new school leadership team that has initiated a number of changes to the school. During the 2012-2013 school year, Bellamy’s fourth school year, 564 students, Pre-Kindergarten through ninth grade were enrolled, an increase in population of 343 students since the charter’s inception in the 2009-2010 school year in which there were 221 students. Bellamy’s enrollment was comprised of 564 students with 261 females and 303 males, 78.5% of those being Caucasian, 7.4% African American, 10.2% Hispanic, 2.3% Asian, and 1.4% Other. 58% of students received free or reduced lunch. The school has 100% of certified highly qualified teachers.

The faculty has participated in weekly job-embedded grade-level meetings since the new school administration came on board in July 2011. The teachers were organized into grade-level teams, which have met on a regular basis. The majority of the job-embedded collaboration time has been spent in same-grade, same-subject teams (e.g., all third grade teachers), which represents a departure from the more traditional focus on interdisciplinary team collaboration (Erb & Doda, 1989; Rottier, 2001).
In an initial pilot interview for gaining entrée and selecting Bellamy Charter as the study site, the executive director (i.e., school leader, principal) revealed that she was interested in developing a more solid structure for job-embedded professional development based on Murphy’s (2004) Whole-Faculty Study Group model. She indicated that she was very interested in establishing action plans (Murphy, 2004) for each study group as a commitment to guiding the teacher collaboration groups. An action plan serves as a guide for Whole-Faculty Study Groups and members to follow when determining priority goals for student improvement. The initial plan for this study was that the faculty study groups would each develop an action plan for implementing the Common Core State Standards in mathematics based on studying the eight Standards for Mathematical Practice (CCSSM, 2010). However, the executive director did not establish study groups for the entire faculty as planned. Instead, she established a pilot study group composed of the 3rd, 4th, and 5th grade math teacher, and two members of the school’s Leadership Team. This team was the focus of this case study.

The study was conducted for six weeks in the 2012-13 spring semester with follow-up in early fall with study participants attending a one day Whole-Faculty Study Group training. The data was collected through interviews, Whole-Faculty Study Group session observations and written pre- and post-evaluations.

**Research Questions**

In order to improve professional learning and determine its effectiveness in achieving the desired instructional outcomes, an evaluation process should be implemented. Guskey (2000) suggests several levels of evaluation to assess the strengths and weaknesses of professional learning, including: participants’ learning, participants’ use of new knowledge and skills, and student learning outcomes. Guskey suggests that when professional learning is successful, it is
because teachers are supported and held accountable to use the new practices. Moreover, when teachers begin to see that the new practice works, more often than not, they eventually “practice themselves into change.” (2000, p.189)

For this study, research questions were based on professional learning with a focus on participant’s perceived learning. The work could and should have an impact on student learning outcomes. However, for the purposes of this study, the questions will only focus on the professional learning side. This study focused on the following overarching question: What impact has the professional learning from Whole-Faculty Study Group sessions had on teachers’ understanding the most significant contributions of the Standards for Mathematical Practice in preparation of the implementation of the Common Core State Standards in mathematics?

I conducted the study to look at teachers’ understanding the most significant contributions of the Standards for Mathematical Practice because the Common Core math standards actually encompass two kinds of standards, the content standards and the Standards for Mathematical Practice. Since much of the professional development about the Common Core focuses on the content standards, the Standards for Mathematical Practice could easily be overlooked if not emphasized. I also wanted to find out whether job-embedded professional learning could increase teachers’ understanding of the importance of the Standards for Mathematical Practice. As noted in the literature review, there appears to be no research on developing teacher understanding of these math practice standards.

The subordinate research questions and their rationale for inclusion in this study were:
1) What do teachers and administrators perceive as the goal(s) of collaboration in Whole-Faculty Study Groups (WFSG)?

The first two subordinate questions relate to the structure for job-embedded professional learning in this study – the Whole Faculty Study Groups design. Central to the WFSG design is the idea that teachers working together collaboratively learn more and have a greater impact on their classroom practice and student learning than teachers working in isolation. This question sought to discover what the participants perceive as the reasons for implementing teacher collaboration.

2) What factors inhibit or promote collaboration in a WFSG?

The participants in this study were part of a pilot study group. The school plans to launch WFSG with the entire faculty during the 2013-14 school year and the participants in this study will lead the faculty through the WFSG Decision Making Cycle to form faculty study groups. Therefore it is important for the participants to understand the factors that can enhance or inhibit collaboration in WFSGs in their school so that they can ensure that high quality collaboration takes place. This question sought to identify participants’ perceptions of these factors.

3) What is the role of the Standards for Mathematical Practice in the Common Core State Standards for mathematics (CCSSM)?

The rationale for this question lies in ensuring that teachers and administrators understand that the Common Core State Standards in Mathematics (CCSSM) contain both content and practice standards. This question sought to determine whether the participants in this study understood the role of the Standards for Mathematical Practice in the implementation of the CCSSM content standards.
4) Why is it important for teachers to better understand the Standards for Mathematical Practice in the CCSSM?

A fundamental difference between the CCSSM and traditional math content standards is that *how* students learn the CCSSM content standards is just as important as *what* they learn. Student success with the CCSSM requires that teachers are skillful in modeling, teaching, and using the math practice standards as they design performance tasks for students that are linked to the content standards and lead students in developing their proficiency in both the content and practice standards. This question sought to determine whether participants understand their role with regard to the math practice standards and the implications for changing what they and their students do in the classroom.

The foundational practices are key for teachers to grasp the whole picture of what the Common Core Math Standards imply for students to gain mathematical proficiency from grade to grade.

**Data Sources and Records**

The data collection in case study research is typically extensive, drawing on multiple sources of information, such as observations interviews, documents, and audiovisual materials. For example, Yin (2009) recommends six types of information to collect: documents, archival records, interviews, direct observations, participant-observations, and physical artifacts. As is recommended by Yin (2009) and Creswell (2009), this research study was designed to utilize multiple sources of data to ensure a comprehensive investigation and research validity.

In case study research, the researcher must physically go to the teachers and administration team at the site of the charter school in order to observe, interview and collect documents. In this study, I assumed the stance of a full participant observer. As qualitative
research is naturalistic, I led the meetings not to manipulate the situation, but rather to watch naturally occurring events transpire (Guba & Lincoln, 1994).

For this study, the following data sources were used: interviews, a pre- and post-assessment written questionnaire, and observations. A focus group interview with teachers, semi structured individual interviews with selected teachers, and a formal interview with the principal were conducted. A pre- and post-assessment questionnaire was administered to the team members and observations of team meetings were conducted. In addition, document records from the study group sessions and the WFSG training session were collected.

**Interviews**

Interviews were the primary data source. Creswell (2009) and Yin (2009) suggest interviewing can be used for organizational purposes, as well as a valuable source for gathering information. Merriam believes, “…interviewing is necessary when we cannot observe behavior, feelings, or how people interpret the world around them; it is also necessary to interview when we are interested in past events that are impossible to replicate” (2009, p. 88). Interviews were used as primary sources of data for this study because they are, as Creswell states, “a valuable source for gathering information” and, as Merriam believes, for understanding how the participants “interpret the world around them” in relation to the job-embedded professional learning experience with the WFSG design for teacher collaboration and the Standards for Mathematical Practice.

Two types of interviews were used – individual interviews of three math teachers and the executive director and a focus group interview with four of five members of the team (three teachers, and two leadership team members). In addition, team members were asked to respond in writing to two questions at the beginning and end of the professional development
intervention. The focus group interviews and individual interviews were both informal and semi-structured.

The purpose of the interviews was to understand participants’ perspectives on the four subordinate research questions. Presented below are the subordinate research questions, the related interview and focus group questions, and a brief rationale for each interview and focus group question.

1) What do teachers and administrators perceive as the goal(s) of collaboration in Whole-Faculty Study Groups (WFSG)?
   a) Interview Question: What is needed for successful collaboration?
      In order to understand the goal for collaboration in WFSG, participants need to understand first what successful collaboration is. This interview question sought to identify participants’ perceptions of the characteristics of successful collaboration.
   b) Focus Group Question: How do you utilize collaboration to achieve your vision?
      How teachers and administrators utilize collaboration is their goal in practice for collaboration, the focus of this subordinate research question. The purpose of this focus group question was to generate participants’ ideas about the uses of teacher collaboration.

2) What factors inhibit or promote collaboration in a WFSG?
   a) Interview Question: What expectations for meetings encourage collaboration?
      Factors that enhance or inhibit collaboration in group work exist at two levels, within the group and in the surrounding context. The foundation for this interview question is the guidelines and principles of collaboration in group meetings.
   b) Focus Group Question: What systems, resources, and relationships support collaboration?
The rationale for this focus group question was to examine participants’ perceptions of the surrounding context for organizational and cultural supports for teacher collaboration.

3) What is the role of the Standards for Mathematical Practice in the Common Core State Standards for mathematics (CCSSM)?
   a) Interview Question: How do these Practices relate to math content standards?
      The basis for this interview question was to elicit participants’ understanding of the relationship between the CCSSM math practices and the content standards.
   b) Focus Group Question: What might be the result if you focus on these Practices in isolation of the math content standards?
      This focus question probed participants’ thinking about the relationship of the practice and content standards and why the practice standards are essential to the implementation of the Common Core Standards in mathematics.

4) Why is it important for teachers to better understand the Standards for Mathematical Practice in the CCSSM?
   a) Interview Question: How is the role of teacher when implementing the Math Practices different than the expected role of the past?
      Understanding the shifts in the Common Core math standards implementation is centered on the changed role of the teacher when implementing the Math Practices. This interview question sought to identify participants’ perceptions of how the teacher role is changed.
   b) Focus Group Question: What is the primary role of the student in implementing the Math Practices?
Implementation of the common core math standards requires that student roles change in addition to teacher roles. This focus group question sought to elicit participants’ perceptions of how the students’ role changes with the implementing the math practices.

**The Focus Group Interview.** In a focus group, an interviewer will develop a list of discussion questions and then let the discussion of the group develop from there. While still structured to a certain extent, focus groups are much more free form than a traditional interview because the interviewer needs to let the discussion develop naturally and take its normal course (Creswell, 2009).

The benefits of focus groups are that they allow a lot of responses from many different individuals in a short amount of time. Also, because the interviewer is only developing discussion questions (not direct interview questions) and the intimidation some participants might feel from the interviewer is minimized by being part of a group, most focus group participants feel more comfortable and are often more forthcoming than they would be in a one-on-one interview. However, a problem with focus groups is that group dynamics can change dramatically from group to group. It can be a challenge to get a cohesive group together that can not only offer pertinent insights for answering your research question but also feels comfortable enough together to talk freely in a short amount of time. In a focus group, it is essential that the researcher gets insights from all the participants; however, if certain members are shy or feel intimidated by more dominating or socially powerful members of the group, they may not fully offer their perspectives. Finally, it can be difficult to get the conversation off to a productive start in only an hour or so. Time management of the conversation is key and can be tricky.

In this study the focus group was a small group of four participants inclusive of one leadership team member and three math teachers. The focus group interview was conducted for
45 minutes to probe into the subject matter without exhausting the participants and also due to time constraints of a school’s schedule. The focus group participants were selected on the basis of convenience and were the participants of the study. The location of the focus group interview was a comfortable place if one considers the walls did not go all the way to the ceiling and classroom chatter could be heard—mostly by me as the researcher since the participants have worked in this setting and have learned to tune out the noise from surrounding classrooms.

The participants were asked to provide oral responses to four questions: 1) How do you utilize collaboration to achieve your vision? 2) What systems, resources, and relationships support collaboration? 3) What might be the result if you focus on these Practices in isolation of the math content standards? 4) What is the primary role of the student in implementing the Math Practices?

**The Individual Interview.** Individual interviews share some similarities with the focus group interview. They both produced qualitative data and both attempted to uncover feelings about teacher collaboration and the standards for mathematical practice. Creswell (2009) reflects on the one-on-one interview,

as the researcher needing individuals who are not hesitant to speak and share ideas, and needs to determine a setting in which this is possible. The less articulate, shy interviewee may present the researcher with a challenge and less than adequate data.

There were five individual interviews inclusive of the four faculty members who were a part of the focus group in addition to the executive director. The individual interviews lasted for 30-minutes per participant outside of the instructional day due to limiting the time away from their instructional obligations. The four questions asked included: 1) What is needed for successful collaboration? 2) What expectations for meetings encourage collaboration? 3) How do these practices relate to math content standards? 4) How is the role of teacher when implementing the Math Practices different than the expected role of the past?
**Questionnaire**

According to Maxwell (2005), it is important to use multiple data sources to increase the credibility of the study. In addition, multiple data sources promote a comprehensive analysis that involves systematic decoding where themes and categories emerge. The pre- and post-assessment written questionnaire was the second data source.

This written questionnaire was given to the five participants in the study group sessions to learn about the CCSSM Standards of Mathematical Practice. The reason for asking participants to state in writing their responses to the same questions at the beginning of the first study group session and at the end of the fourth session was to see if the intervention, collaboratively learning about the math practice standards, had changed their thinking on why it is important for teachers to better understand the practice standards and the role of the practice standards in relation to the CCSSM content standards. This is the fourth subordinate research question.

The two questions in the questionnaire were the same as the individual interview and focus group questions used for subordinate research question #4. The rationale for using the same questions that were used in the interviews was to determine not only whether participants shifted their thinking from the first to the fourth session but also to determine if their written post-assessment responses were similar to their oral responses in the individual interviews and in the focus group interview. The two questions asked included: 1) How is the role of teacher when implementing the Math Practices different than the expected role of the past? (This question was the individual interview question for the fourth research question.) and 2) What is the primary role of the student in implementing the Math Practices? (This question was the focus group interview question for the fourth research question.)
Observations

The third data source was observation notes from passive participation observation (Spradley, 1970). This form of observation is where the observer is present at the scene but is not participating at all in the scene. In fact, other people there may not even notice the observer. For example, taking observation notes of a class that you are not a part of or getting a grade in would be a form of passive participation. In passive participation, it is quite easy for the observer to take notes while he or she is at the scene.

Two educators not associated with the charter school made the passive participation observations. They attended the Whole-Faculty Study Group sessions and prepared field notes. These educators recorded observations of sessions on perceived participants’ application and understanding of the CCSS Standards for Mathematical Practice. In addition, I also recorded field notes of my observations during sessions.

Records

Records of the study for document analysis included an Action Plan describing the work to be done by the study group along with four meeting logs. There was also an agenda and evaluations analyzed from the one-day Whole-Faculty Study Group training conducted in the fall 2013. These records were used as secondary sources of data for this study because they were linked to the research questions. The action plan provides evidence of the group’s goals for collaboration in their study group meetings. The meeting logs described what they did in each session and their reactions, questions, and concerns. They provide evidence about their goals for collaboration at each meeting, factors that might enhance or inhibit collaboration, and their growing understanding of the math practice standards and the roles of teachers and students with these standards. The agenda and evaluations from the WFSG training session relate to deepening
participants’ understanding of the WFSG design, the goals for collaboration, and their reactions to the training.

Role of Researcher as Full Participant Observer

Creswell (2009), defines participant observer as the researcher who gathers information in many ways, the primary approach is to observe the culture-sharing group and become a participant in the cultural setting. Jorgensen (1989) describes participant observer as being on a possible continuum from being a complete outsider to being a complete insider. As the researcher in the study, I was a full participant observer. I participated in team meetings and facilitated the exploration of the eight Common Core Standards for Mathematical Practice, observed study group meetings, conducted individual and focus group interviews, and collected records.

Interventions and Data Collection

This study focused on whether teachers working collaboratively in a WFSG study group both perceived the benefits of successful collaboration as they engaged together in the content during four study group sessions and whether they developed a better understanding of the content. The content for the study group sessions came from the Common Core State resources found within the Louisiana Department of Education’s Teacher Support Toolbox on the department’s website, www.louisianabelieves.com. Three modules from the Teacher Self-Learning Series were used. All three modules were designed to provide an in-depth look at the Standards of Mathematical Practice, which are part of the Common Core State Standards for Mathematics. A brief description of each module follows (Louisiana Department of Education, 2013c).
Module 4: A First Look at the Standards for Mathematical Practice focuses on developing an initial understanding of the Standards by Mathematical Practices by closely examining the wording of the descriptions for each practice and viewing instructional videos in which evidence of a practice can be found. By the end of the module, the learner will be able to: a) identify the roles that teachers and students play when Standards for Mathematical Practice are implemented, and b) find examples of use of a practice when viewing an instructional video.

Module 5: The Standards for Mathematical Practice—Connecting the Practices to Content Standards focuses on how the practices connect to the content standards using tasks as examples. Additionally, there is a short section on the interrelatedness of the Math Practices, which provides another lens through which to view the connections to the content standards. Links to descriptions to help differentiate the expected proficiencies by grade level are also included in this module. By the end of the module, the learner will be able to identify which practices are aligned to a task based on the grade level of a student.

Module 6: Standards for Mathematical Practice—Implementation in the Classroom focuses on strategies for implementing the practices in the classroom, determining the degree of students’ progress towards meeting the practices, and using an observation tool to ensure that practices are evident in a classroom. By the end of this module, the learner will be able to a) understand how to determine the progress that a student is making in meeting a practice, b) state how specific instructional strategies are used to promote the use of practices and increase student achievement, and c) use an observation tool to identify ways to make math practices visible to observers in the classroom and to assist in understanding the meanings of the practices.

Table 3.1 summarizes the timeline and activities during this study and the data collected at each intervention. The appendices include the questions for focus group interviews (Appendix
A), questions for individual teacher interviews (Appendix B), and questions for the pre-/post-assessment written questionnaire (Appendix C).

Table 3.1
Timeline of Activities and Data Collected

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Data Collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Visit with Executive Director and meet with teachers to explain WFSG process and obtain consent signatures</td>
<td>Signed consent forms</td>
</tr>
<tr>
<td>(April 2013)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 2</td>
<td>Study Group Meeting #1 (1-hour)</td>
<td>• Study Group Action Plan</td>
</tr>
<tr>
<td>(May 2013)</td>
<td>• Complete pre-assessment questionnaire</td>
<td>• Study Group Log</td>
</tr>
<tr>
<td></td>
<td>• Develop Study Group Action Plan</td>
<td>• Pre-assessment</td>
</tr>
<tr>
<td></td>
<td>• Collaborative study of Module 4, A First Look at the Standards for Mathematical Practice</td>
<td>Questionnaire responses</td>
</tr>
<tr>
<td></td>
<td>• Complete Study Group Log</td>
<td>• Observation notes from passive participants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Notes by the author who facilitated the session</td>
</tr>
<tr>
<td>Week 3</td>
<td>Study Group Meeting #2 (1-hour)</td>
<td>• Study Group Log</td>
</tr>
<tr>
<td>(May 2013)</td>
<td>• Collaborative study of Module 4, A First Look at the Standards for Mathematical Practice</td>
<td>• Observation notes from passive participants</td>
</tr>
<tr>
<td></td>
<td>• Complete Study Group Log</td>
<td>• Notes by the author who facilitated the session</td>
</tr>
<tr>
<td>Time</td>
<td>Activity</td>
<td>Data Collected</td>
</tr>
<tr>
<td>---------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Week 4</td>
<td>Study Group Meeting #3 (1-hour)</td>
<td>• Study Group Log</td>
</tr>
<tr>
<td>(May 2013)</td>
<td>• Collaborative study of Module 5, The Standards for Mathematical Practice – Connecting the Practices to Content Standards;</td>
<td>• Observation notes from passive participants</td>
</tr>
<tr>
<td></td>
<td>• Complete Study Group Log</td>
<td>• Notes by the author who facilitated the session</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 5</td>
<td>Study Group Meeting #4 (1-hour)</td>
<td>• Study Group Log</td>
</tr>
<tr>
<td>(May 2013)</td>
<td>• Collaborative study of Module 6, Standards for Mathematical Practice – Implementation in the Classroom</td>
<td>• Study Group Action Plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Post-assessment Questionnaire responses</td>
</tr>
<tr>
<td></td>
<td>• Complete Study Group Log</td>
<td>• Observation notes from passive participants</td>
</tr>
<tr>
<td></td>
<td>• Update Action Plan</td>
<td>• Notes by the author who facilitated the session</td>
</tr>
<tr>
<td></td>
<td>• Complete post-assessment questionnaire</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 6</td>
<td>• Individual interviews with 3 math teachers</td>
<td>• Audio tapes of interviews</td>
</tr>
<tr>
<td>(June 2013)</td>
<td>• Interview with focus group (all 5 members of study group)</td>
<td>• Transcriptions of the interview responses by each participant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Interview notes by the author who conducted the interviews</td>
</tr>
</tbody>
</table>
I had to make two adjustments during the study. I reduced the number of the participants from 1 school administrator, 1 curriculum coordinator, 1 remedial teacher, and 6 teachers to 1 school administrator, 2 leadership team members, and 3 math teachers. The reason for this was that the school had not yet launched study groups for all teachers. So the executive director and I decided to focus the study on a pilot group that consisted on one math study group. Another adjustment was the administrators’ interview took place outside of the six-week study due to her not being available during the time when the other individual interviews were conducted.

**Data Analysis**

Yin (2009) contends the analysis of case study results is generally the most complicated component of the process for neophyte researchers. Boyatzis (1998) posits interpretations of data can only be as valid as they are reliable and validity is assured, only when multiple sources
are utilized (Yin, 2009). Creswell (2009) advised researchers that they should provide an accurate account of information and data interpretation that is easily verifiable among participants and multiple data sources. He also suggests a well-organized design promotes accurate analysis because it enables the researcher to remain focused upon learning about the participants and their problems.

**Procedures for Data Analysis**

The study generated a significant amount of data in multiple forms (e.g., participants’ reflections, study group action plans, study group logs, interviews, observation notes, and my reflective logs). Data analysis comprises of making sense out of collected data; it is the course of action to systematically search and arrange accumulated data to increase personal understanding, in order to present what one discovers to others (Bogdan & Bicklen, 1998).

**Coding Raw Data.** Raw data, which was the textual data responses from the focus group interview, individual interviews, the pre- and post-assessment written questionnaire, and the observation notes from study group sessions were individually coded by the author. I highlighted words and phrases that provided insights into participants’ perceptions about teacher collaboration and standards for mathematical practice knowledge and skills necessary for teachers to be prepared for the implementation of the CCSS in mathematics.

Participant responses were analyzed using open, in vivo, coding, an inductive content analysis (Strauss & Corbin, 1990) that safeguards the actual language of participants and helps to ensure that the participants’ voices are respected (Saldana, 2009) and Creswell’s constant comparative method (1998) that involved continuous cycle of conception and categorization. The subsequent coding was carried out using pattern coding which facilitates populating major themes and examines patterns in human relationships and social networks (Saldana, 2009).
Categories were developed from similar codes. Some categories were fairly simple to ascertain. For example, if someone wrote time, that specific code became a category. Other responses were less clear-cut, and through my own lens of experience, I interpreted responses and developed categories.

The following example illustrates how categories for the second subordinate research question on factors enhancing collaboration were developed. Process/WFSG (initially coded 16 times), make-up of study group membership (initially coded 1 time), and action plans (initially coded 2 times) formed the category for deliberate organization of team members (occurring with a frequency of 19). A second category, schedules, was established for the code for “time” (initially coded 16 times). Shared responsibility of study group roles (initially coded 5 times) formed the third category, facilitation. The fourth category, expectations, was generated from group norms (initially coded 3 times). These four categories were combined to establish the theme of having structures in place.

There were four instances in this example where the code became the category but I gave the category a different name. When looking at the wording that went with the codes such as time, I realized that there was more information than just time, such as study group times written on a schedule and placed on a calendar. The participants also elaborated on group norms being about expectations around teachers needing to know the purpose of the meetings and what to expect at collaboration meetings such as rules or guidelines. For shared responsibility, the responses were about roles and responsibilities around how to facilitate the meetings and who leads the meetings.

**Developing Themes.** As shown in the example above, themes were developed from the categories identified from participant responses to each of the four subordinate research
questions. The responses came from the focus group with teachers and administrative leadership team members and from the individual interviews with math teachers and the executive director, and written responses from participants to a pre- and post-written assessment. The observation notes and the study group action plan and logs from the study group sessions were used as secondary data for this exploration.

**Biases**

Due to the nature of the types of inquiry associated with qualitative research and the methods of data collection, it is vital that the researcher not allow any personal beliefs to bias the data. As stated earlier, the researcher is the “key instrument” (Creswell, 2009, p. 38). As a participant in conducting the research, one cannot say that bias was completely eliminated from the study. However, I attempted to draw directly from the data the critical issues that impacted Whole-Faculty Study Group sessions as stated by participants, while attempting to be continually cognizant of any interpretation that did not allow for a valid and trustworthy analysis of the data.

Asking participants questions based on sessions I conducted can be viewed as a potential bias. In addition, since this was a purposeful, convenience sample (Collins Onwuegbuzie, and Jiao, 2007), of participants from a school with which I worked, there was a natural selection bias present in these findings. Additionally, my lens of experience might have been a potential bias. As a former elementary math teacher and coordinator who implemented the Whole-Faculty Study Group process in schools, and was working in a state leadership position, my history could have influenced my analysis.

One measure to mitigate bias is an external reviewer who inspects the raw data and the results in order to determine that the presentation of data and results in the study are not skewed in any way (Stanley, 2012). I engaged the Director of the National Whole-Faculty Study Groups Center, who has an Ed.D. in Educational Leadership, to perform this function.
Trustworthiness

The trustworthiness of the study was acquired through the standards of validation established by Lincoln and Guba (1985), in their book *Naturalistic Inquiry*. According to Lincoln and Guba, there are four components of trustworthiness to be followed when conducting qualitative research and they are as follows: truth value, applicability, consistency, and neutrality. By pursuing the four components of trustworthiness, the researcher will help to ensure credibility, transferability, dependability, and verifiability of the study (Lincoln & Guba, 1985).

The truth value was determined by the data collection activities, which included descriptive and focused observations of the study group sessions, formal individual interviews, the focus group interview, and the pre- and post-assessment written questionnaire. The triangulation of the data ensured the accuracy of the study as information was collected from different data sources and from participants both individually and in a focus group. This speaks to the credibility of the study. The purposeful sampling of the participating subjects and setting for the study determined the applicability of the study. The sampling of the setting and subjects, with a setting of a rural elementary charter school and participants who were teachers and leadership team members with a range of experience, as well as the detailed descriptions, also addresses the transferability of the study. The processes performed during data collection, such as the collection of records and observation notes for the study group sessions in addition to my own notes, determined the consistency of the study. Consistency was also enhanced by comparing my observational notes with my theme analysis of data from the various data sources. All of this supported the dependability of the study. Linking the discussions in the sessions and the interviews to the module content preserved the neutrality of the study. This speaks to the verifiability of the study. It was my hope that by endorsing all four components of
Lincoln and Guba’s (1985) standards of validation, trustworthiness of the study would be established.

Summary

This chapter describes the methodology used for a study in a rural elementary charter school in north Louisiana. A qualitative case study design was selected to gain an in-depth understanding of how one group of educators coalesced into a collaborative group and gain content and pedagogical knowledge about the CCSSM. The theoretical framework used to design the job-embedded professional learning sessions was the Whole Faculty Study Groups design for collaborative teacher teams. I selected a setting, Bellamy Charter, and the participants, six Leadership Team members and teachers, as a bounded case based on criterion and convenience sampling. An overarching research question and four subordinate research questions were identified based on the literature review in chapter two. The questions focus on an examination of how a professional learning collaborative structure influenced participants’ perceptions of collaboration and the eight CCSS Standards for Mathematical Practice.

The primary data sources were individual interviews, a focus group interview, and questionnaire with individual written responses before the sessions began and after they were completed. Observation notes from passive observers were used to triangulate the data collected from interviews and the questionnaire. The interview and questionnaire data were coded using open, in vivo, coding and codes were aggregated into categories and themes using Creswell’s constant comparative method of conception and categorization (1998). Finally, the chapter discusses potential biases of the research with me serving as both participant in the sessions and as researcher and the trustworthiness of the data collected.
Chapter four presents the findings from this study as they apply to the four subordinate research questions and the overarching research question. Chapter five contains a discussion of implications, recommendations, and conclusions, which are particularly timely as Louisiana experiences both an expansion of charters schools and implementation of the CCSS math standards.
CHAPTER 4: RESULTS

Introduction

The purpose of this chapter is to report and discuss the key findings of the research conducted over a six-week period. The first section provides a brief review of the study context inclusive of the research question and subordinate research questions as well as descriptions of participants and learning teams. The second section presents the emerging themes for each subordinate research question, using the collected data in the form of responses to focus group and individual participant interviews and to a pre- and post-written assessment, study group session observations in addition to analyzing records from the sessions. The final section presents a summary of the key research findings followed by a conclusion.

Study Context

This single-case study (Yin, 2003) was conducted at one North Louisiana charter school. The purpose of the study was to explore whether a team of teachers who participated in the study would be prepared to transition to the CCSS in mathematics in the fall of the 2013-14 school year with full implementation of standards and assessments—Partnership for Assessment of Readiness for College and Careers (PARCC 2011)—the following 2014-15 school year. The overall guiding question of the research was: What impact has the professional learning from Whole-Faculty Study Group sessions had on teachers’ understanding the most significant contributions of the Standards for Mathematical Practice in preparation of the implementation of the Common Core State Standards in mathematics? The subordinate research questions in this study were:

1) What do teachers and administrators perceive as the goal(s) of collaboration in Whole-Faculty Study Groups (WFSG)?
2) What factors inhibit or promote collaboration in a WFSG?

3) What is the role of the Standards for Mathematical Practice in the Common Core State Standards for mathematics (CCSSM)?

4) Why is it important for teachers to better understand the Standards for Mathematical Practice in the CCSSM?

The study took place over the course of six-weeks. The essential components of teacher and administrator input were elicited formally through observations of learning team meetings, one-on-one interviews and a focus group interview, written responses to a pre- and post-written assessment, and the collection of records from the learning team meetings. Two passive observers and I met with one math learning team over the course of four one-hour sessions, each of which included five participants. Ms. Collins, a sixth participant of the study, visited the sessions from time-to-time.

The six participants in the study were the executive director, two administrative leadership team members, and a third, a fourth, and a fifth grade math teacher with their demographic characteristics summarized in Table 4.1. Pseudonyms were used for each participant to protect identities. I assumed a full participant position within the study and met with the three math teachers and two administrative leadership team members during job-embedded time for the four study group meetings to facilitate the team’s work with three study modules about the Common Core State Standards for Mathematics: A First Look at the Standards for Mathematical Practice, Connecting the Practices to Content Standards, and Implementation in the Classroom while two passive participants took observational notes.
<table>
<thead>
<tr>
<th>Position and Name Used</th>
<th>Race/Gender</th>
<th>Total Years Experience</th>
<th>Bellamy Charter Experience</th>
<th>Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Director</td>
<td>White Female</td>
<td>18</td>
<td>3</td>
<td>B.A. and M. Ed. Degrees in Elementary Education</td>
</tr>
<tr>
<td>Addison Collins</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leadership Team Member</td>
<td>White Female</td>
<td>8</td>
<td>4</td>
<td>M.A.T. Elementary Education</td>
</tr>
<tr>
<td>MaKayla Steele</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leadership Team Member</td>
<td>White Female</td>
<td>19</td>
<td>4</td>
<td>B.A. Elementary Education</td>
</tr>
<tr>
<td>Anne Wiggs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third Grade Math Teacher</td>
<td>White Female</td>
<td>6</td>
<td>1</td>
<td>B.S. Elementary Education</td>
</tr>
<tr>
<td>Rowan Delaney</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fourth Grade Math Teacher</td>
<td>White Female</td>
<td>30+</td>
<td>3</td>
<td>B.A. Elementary Education</td>
</tr>
<tr>
<td>Saige Jensen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fifth Grade Math Teacher</td>
<td>White Female</td>
<td>30+</td>
<td>2</td>
<td>B. A., M.Ed., +30 Degrees in Elementary Education; 25 hours completed toward a Ph.D.</td>
</tr>
</tbody>
</table>
For the interviews, I met individually with the executive director and the three math teachers outside of the school day and asked them a series of four questions. Four additional questions were asked when conducting a small focus group conversation with the three math teachers and one of the leadership team members. Both of these interview approaches connected to four subordinate research questions of the study: a) teachers’ and administrators’ perceptions of the goal(s) of collaboration in WFGs, b) factors that inhibit or promote collaboration in a WFG, c) perceived role of the Standards for Mathematical Practice in the CCSS, and d) perceived importance for teachers to better understand the Standards for Mathematical Practice in the CCSS. See Appendix A and B for the interview protocol questions.

In addition to participating in the focus group interview, the members of the math learning team were asked to respond in writing to two questions as a pre- and post-assessment exercise. The questions related to the last two subordinate questions about the perceived role of the Standards for Mathematical Practice and the perceived importance for teachers to better understand the practice standards. See Appendix C for pre- and post-assessment written questions. Table 4.2 summarizes the number of participant responses for each of the subordinate research questions.

Table 4.2
Participant Responses for the Subordinate Research Questions

<table>
<thead>
<tr>
<th>Subordinate Research Question</th>
<th># of Individual Interview Responses</th>
<th># of Focus Group Interview Responses</th>
<th># of Pre- &amp; Post-Assessment Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceptions of the goal(s) of collaboration</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 4.2 continued

<table>
<thead>
<tr>
<th>Subordinate Research Question</th>
<th># of Individual Interview Responses</th>
<th># of Focus Group Interview Responses</th>
<th># of Pre- &amp; Post-Assessment Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors that inhibit or promote collaboration</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Perceived role of the Standards for Mathematical Practice</td>
<td>4</td>
<td>4</td>
<td>9 (5 Pre- &amp; 4 Post-)</td>
</tr>
<tr>
<td>Perceived importance for teachers to better understand the Standards for Mathematical Practice</td>
<td>4</td>
<td>4</td>
<td>9 (5 Pre- &amp; 4 Post-)</td>
</tr>
</tbody>
</table>

**Emerging Themes**

This section presents the emerging themes from analyzing the interview and questionnaire responses, observation notes, and records organized by the four subordinate research questions. The section concludes with a discussion of how the emerging themes for each of the four subordinate research questions answer the overarching research question: What impact has the professional learning from Whole-Faculty Study Group sessions had on teachers’ understanding the most significant contributions of the Standards for Mathematical Practice in preparation of the implementation of the Common Core State Standards in mathematics?

**Research Subordinate Question #1: What do teachers and administrators perceive as the goal(s) of collaboration in WFSG?**

The interview questions under this subordinate question were a) Individual Interview Question: What is needed for successful collaboration? and b) Focus Group Interview Question:
How do you utilize collaboration to achieve your vision? After coding all of the individual and focus group interview responses to these questions line-by-line, two themes were identified:

Teachers and administrators perceive that the goal for collaboration in WFSGs was to (1) empower teachers and (2) establish common goals among teachers. The themes and categories are shown in Table 4.3.

Table 4.3  
Themes with Categories from Participants’ Responses for Research Subordinate Question #1

<table>
<thead>
<tr>
<th>Theme: Empower Teachers</th>
<th>Theme: Establishing Common Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Categories</td>
<td>Frequency</td>
</tr>
<tr>
<td>1. Teachers working together</td>
<td>20</td>
</tr>
<tr>
<td>2. Fosters a shared responsibility</td>
<td>5</td>
</tr>
</tbody>
</table>

**Empower Teachers.** This theme, which was constructed from two categories of participant statements, is about enabling teachers to work together in a way that fosters a shared responsibility. The first category, teachers working together, was the most frequent comment among participants about the goal of collaboration in WFSGs. The teachers expressed that they needed the opportunity to meet together to take chances and make a change from the way they taught the state-run Comprehensive Curriculum to the way they need to teach the Common Core State Standards in mathematics. Ms. Alexander explained that under the state-run Comprehensive Curriculum that preceded the CCSS the emphasis was on “teacher-direct instruction” and added:

Implementing the Math Practices in the classroom will require giving students more opportunities for discovery learning, group learning, and designing real-life projects. The teacher becomes a facilitator. Without the [math] practices, a teacher could rely more on direct instruction and rote [learning].

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Team members realized that the practices required significant shifts in the way they designed tasks for students and the way that they teach. They also realized that the best way to accomplish these shifts was through working together as a team, as they did in this study.

Participants also expressed that working together collaboratively was empowering for teachers. Ms. Alexander, the fifth-grade teacher, expressed the prospect of being competitive with other states. She extended the discussion to the state’s new support strategy which is to empower those closest to students to make decisions which leads to teacher empowerment as well as a shared responsibility among faculty members. She further elaborated that administrators have the opportunity to empower teachers, teachers have the opportunity to make curriculum decisions for their students, and students have the opportunity to reach their full potential that fosters a shared responsibility among all. Ms. Alexander continued, “When done correctly, collaboration makes you feel like you are not an island unto yourself as a teacher. It makes the team feel responsible together for decision-making and frankly empowers teachers.”

Ms. Collins, the executive director, echoed this sentiment when she stated that in the WFSG process “(t)he teachers are in charge of the process with shared leadership.”

The second category, fosters a shared responsibility, was discussed among members during the initial Whole-Faculty Study Group session as one of the WFSG process guidelines that every member of a study group serves as a leader on a rotating basis. For the purposes of this six-week study, leadership rotation was not implemented but can be for future meetings. Ms. Alexander referenced the shared responsibility aspect of teacher collaboration: [it provides] “professional connections as there is a shared responsibility for decision-making. Everyone MUST [participant emphasis] understand the goals/objectives of the meetings and everyone MUST [participant emphasis] understand their role [i.e., leader, recorder, etc.] and jobs [i.e.,
examine student work, analyze data, etc.] within the groups.” Ms. Collins stated during her interview:

We, as an administrative leadership team at Bellamy Charter School, advocate that all participants foster a shared responsibility for the effectiveness of these meetings. Successful meetings do not happen by accident. Our vision of successful teacher collaboration is that everyone is a facilitator. That is one reason I am sold on the Whole-Faculty Study Group structure where leadership is shared; yet equal.

While the discussion of shared responsibility began with reviewing the WFSG guidelines for rotating roles in study group meetings, the participants’ responses indicate that their work together led them to realize that shared responsibility is about much more – shared responsibility for thoughtful decision-making, the effectiveness of meetings, the quality of teaching, and all students learning.

**Establishing Common Goals.** This theme is about establishing common goals connected to student-driven needs and increased student achievement. Increased student achievement is one category under the theme of establishing common goals. Increased achievement is related to not only students’ class grades, but also their overall performance on the various standardized state assessments they take within the given academic year with PARCC assessments on the horizon for the 2014-2015 school session. All of the study participants during the Whole-Faculty Study Group sessions commented they know that student achievement will increase with having teacher collaboration time focused on common goals. Ms. Jensen, the fourth-grade teacher, epitomized this shared understanding when she stated:

Yes, I think that it will definitely increase student achievement. Teachers will have to teach differently than they have in the past with the Common Core State Standards. We are also being evaluated on a new evaluation system during this time. We need the time to work together as teachers to discuss student needs to help them learn how to implement the Standards for Mathematical Practice to increase their thinking processes to match the more rigorous standards and assessments.
The second category, student-driven needs, was linked to comments about common goals for three of the four respondents for these interview questions. Ms. Delaney, the third-grade teacher, summarized comments when she said:

I feel that one of the major goals of collaboration in teacher study groups is to bring the teachers together on a common page and set everyone working toward a common goal. For example, if fourth grade teachers can tell third grade teachers some weaknesses found in the fourth grade class in math, then the third grade teachers can better prepare their students and they have a focus.

Ms. Jensen added, “We work toward goals as a team in order to be successful.” Similar to teachers’ responses, Ms. Collins, the executive director, also noted that teacher collaboration deserves purposeful attention so that common goals are established and met by all members. She also expressed that “having a system in place for a professional learning community is doable and that what teachers learn in study groups will impact student achievement, which, of course, is our overall outcome.”

The analysis of the records and observation notes helped to highlight teachers’ and administrators’ perceptions of the goal(s) of collaboration in WFSGs as empowering teachers and establishing common goals. Through this study’s collaboration and ongoing interaction during the study group sessions, teachers shared common goals such as all work at the same time on a particular strategy in their math classes after viewing the videos of CCSS exemplar lessons to enhance their teaching of math. Ms. Alexander remarked:

It [collaboration] empowers me to get started on the work of the common core state standards in ways that will help us as a learning community at the school. I would love to meet more over the summer as a whole math group to share all that we have studied in this short time and go even more in-depth with the materials.

Overall, both teachers and leadership team members saw the goal of collaboration in WFSG study groups to be working together to achieve common goals that improve student achievement. They also realized that working together in study groups fostered a sense of shared responsibility
and empowerment among teachers. The analysis of interview responses related to the first subordinate research question did not generate any codes that were outliers to the categories and themes described above.

**Research Subordinate Question #2: What are factors that inhibit or promote collaboration in WFSG?**

The second subordinate research questions were a) Individual Interview Question: What expectations for meetings encourage collaboration? and b) Focus Group Interview Question: What systems, resources, and relationships support collaboration? Upon a review of all data gathered from individual and focus group interviews as well as observational notes from teacher collaborative sessions, two themes were established. Factors that promote collaboration in WFSG were a) having structures in place and b) resources to connect teacher actions to student outcomes. The themes and categories are shown in Table 4.4.

<table>
<thead>
<tr>
<th>Theme: Structures in place</th>
<th>Categories</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Deliberate organization of team members</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>2. Schedule</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>3. Facilitation</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>4. Expectations</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Theme: Connecting resources</th>
<th>Categories</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Accessibility of shared resources</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2. Examining Student Work</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**Structures in place.** Team members felt in order for their school to improve the quality of collaboration, and, thus, student outcomes, there needed to be structures in place. When asked
what systems, resources, and relationships support collaboration, the overall comment that received the most attention was deliberate organization of team members. Ms. Delaney, the third-grade teacher, shared during her individual interview that one factor that promotes collaboration would be having teachers of the same subjects or grade levels working together. She did not think it would be as effective for a kindergarten teacher and a sixth grade teacher to be in collaboration together as it would be for fifth and sixth grade science teachers to be in collaboration. Her points centered around groups being organized intentionally - based on study group membership by subject, grade, or need, etc. This emerged as important to participants and connected with the statements they made in response to the first research question about the importance of shared responsibility in decision-making. The decision about how to form study groups must be deliberate and teachers must be involved in the decision-making process.

The category of schedules, noted almost as frequently as deliberate organization of team members, means providing teachers and administrators with an established scheduled time for teacher teams within the school day (job-embedded), and further, it is guarded or protected time for teachers to work collegially with their peers. During individual and focus group interviews, sixteen responses indicated scheduled time for collaboration as a positive aspect of learning teams. As a leadership team member, Ms. Steele revealed, “We have teachers working together but want a stronger cohesive unit for a [scheduled] time of study to learn the new Common Core State Standards and the new state evaluation system components.” Under this thought, Ms. Collins also noted the various approaches to collaboration:

Having a [scheduled] time and location to meet on a regular basis so a calendar with a meeting schedule is a much needed system to have. The structure of the Whole Faculty Study Group process would provide a system for building relationships among faculty. Our leadership team at the school is supportive of teachers working collaboratively which is support needed to guard the meeting time.
These comments culled from interview data revealed the importance of structured, intentional time for collaboration. It was clear from the data that this time had to be designated or protected in order for collaboration that was serious and focused to occur. In other words, participants indicated that collaboration could not be left to fortuity or happenstance.

The next category under having structures in place is facilitation, which was presented and discussed in the collaborative meetings as meetings being facilitated by a knowledgeable and trusted leader. Ms. Jensen pointed out the importance of this when she stressed to the group about the objectives of having an agenda and a leader to be prepared to lead the meeting. “It takes EVERYONE [participant emphasis] being prepared and ready to discuss the topics.” Ms. Jensen’s comment about everyone being prepared for meetings related to the concept of shared responsibility in that all members of a team are responsible for making the meeting a success and can take turns facilitating the meetings. Team members are the knowledgeable and trusted leaders.

The last category under having structures in place is expectations so that teachers know the purpose and what to expect at collaboration meetings. Ms. Jensen suggested group norms provide guidelines so that EVERYONE [participant emphasis] is prepared and ready to have the meeting discussions. Ms. Alexander provided three items expectations should include: 1) clear understanding of goals/objectives, 2) time for outlining concerns without venting and acknowledging what works, 3) each person clearly understanding their role in the plan and how it dove-tails with the other roles and the big picture. These comments by participants about the importance of a team developing its own set of group norms to follow and having clear expectations for what the team is to accomplish help to ensure that meetings are effective.
Establishing written group norms is a way to foster a sense of shared responsibility. Having clear expectations reinforces the importance of having common goals.

**Connecting resources.** Throughout discussions and focus groups, study group members continually circled back to accessibility of shared resources as a key benefit. Accessibility to both material resources and assistance from peers and leadership team members was a category under this theme. The study group sessions during this study focused on conversations around the importance of resources that connect teacher actions to student outcomes such as examples of exemplary student work. During the individual interview Ms. Collins specified, “Having as resources to study will be the Common Core State Standards in ELA and Math with the use of the state’s newly produced assessment guides will support the collaborative work of each of the study groups.” Ms. Delaney indicated that a supportive administration is the most supportive [resource] for teacher collaboration. One of the leadership team members agreed that the school leadership team is supportive of teachers working collaboratively. The participants emphasized that once teacher collaboration teams are created, they need resources to do their work and they need ongoing support from the executive director and the leadership team. They felt study groups working in isolation was only marginally better than teachers working in isolation.

The alignment of structures pivoted around teachers examining student work together to determine strengths and/or weaknesses against exemplars was indicated by this group of teachers as another key to high quality collaboration. For instance, Ms. Wiggs liked viewing a video during the study group session because it enabled the team to focus on what students in the video were doing with the math practices and then to analyze the rigor of the work students produced against exemplars. The team realized that they could follow the same process to identify what they need to change to improve student learning based on looking collaboratively at student work
and then plan to incorporate these changes into their daily practice. Through the video activity and the following discussion, participants discovered that teachers collaborating to improve student achievement demands close examination of student work to uncover what students are thinking and how they are using the math practices, not just whether they got the correct answer.

Participants also identified factors that inhibit collaboration. One hindering factor that Ms. Jensen pointed out during her individual interview was that collaboration in meetings can be hindered by a lack of time to really talk about objectives. Another hindering factor she mentioned was having disjointed discussions because people are not prepared, “…it takes EVERYONE [participant emphasis] being prepared and ready to discuss the topics.” Ms. Alexander added to those comments expressed by Ms. Jensen during her individual interview as “time constraints, of course, can inhibit teacher collaboration.” She remarked:

And in the past, (not at my current school), my previous faculty has met with opposition from administration for collaboration. When you have a competent administrator, such as we have at my school now, he or she understands that teacher collaboration and the administration’s providing of time FOR it, make for happier teachers and far more productive teachers.

Many of the participants’ comments about hindering factors were the absence of the factors that support collaboration, unclear expectations, no group norms, no common goal, no deliberate organization of teams.

The analysis of the observation notes, specifically reviewing comments made by the passive observers of the study group sessions, clarified an understanding about teachers’ and administrators’ perceptions of the factors that support or restrain [high quality] collaboration. One observer noted that Ms. Steele’s assertion in the initial study group session that she wants teachers to know what is expected from the collaborative team-work in advance. The fifth grade teacher, Ms. Alexander, talked about establishing a group norm for what is said here stays here so that everyone feels comfortable in the collaborative setting and knows what to expect. These
statements reinforced the comments above about the importance of *expectations* as factors that support collaboration. The analysis of interview responses related to the second subordinate research question did not generate any codes that were outliers to the categories and themes described above.

**Research Subordinate Question #3: What is the role of the Standards for Mathematical Practice in the CCSS?**

The interview and written pre-/post-assessment written questions under this subordinate question were a) Interview Question: How do these Practices relate to math content standards? and b) Focus Group/Assessment Question: What might be the result if you focus on these Practices in isolation of the math content standards? After coding all of the individual and focus group interview responses to these questions line-by-line, two themes emerged: The role of the Standards for Mathematical Practice in the CCSS is to (1) foster mathematical proficient students and (2) enhance mathematical knowledge for teaching. The themes and categories are shown in Table 4.5.

<table>
<thead>
<tr>
<th>Table 4.5</th>
<th>Themes with Categories from Participants’ Responses for Research Subordinate Question #3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theme: Mathematical Proficient Students</strong></td>
<td><strong>Theme: Mathematical Knowledge for Teaching</strong></td>
</tr>
<tr>
<td>Categories:</td>
<td>Frequency:</td>
</tr>
<tr>
<td>Attributes of Higher Order Thinking</td>
<td>12</td>
</tr>
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<td></td>
<td></td>
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</tbody>
</table>

**Mathematical Proficient Students.** Using the two categories that were identified from participants’ responses (Table 4.5), the role of the Standards for Mathematical Practice is for
teachers to have mathematical knowledge for teaching that aligns with the development of mathematical proficient students. Teachers need an appreciation of how fundamental the mathematical practices are to students learning the content. It is essential that teachers maintain or develop a fervor that all students can—and must—develop proficiency with the Mathematical Practices, which are listed in Table 4.6.

Table 4.6
Common Core Standards for Mathematical Practice

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Make sense of problems and persevere in solving them.</td>
</tr>
<tr>
<td>2</td>
<td>Reason abstractly and quantitatively.</td>
</tr>
<tr>
<td>3</td>
<td>Construct viable arguments and critique the reasoning of others.</td>
</tr>
<tr>
<td>4</td>
<td>Model with mathematics.</td>
</tr>
<tr>
<td>5</td>
<td>Use appropriate tools strategically.</td>
</tr>
<tr>
<td>6</td>
<td>Attend to precision.</td>
</tr>
<tr>
<td>7</td>
<td>Look for and make use of structure.</td>
</tr>
<tr>
<td>8</td>
<td>Look for and express regularity in repeated reasoning (Common Core Standards Initiative, 2012).</td>
</tr>
</tbody>
</table>

Attributes or characteristics and behaviors of higher-order thinking was the category that had the most frequent comment among participants about the role of the Standards for Mathematical Practice. This category was derived by combining the codes overarching goal, student-driven, practices, and higher order thinking.

For example, Ms. Delaney communicated that these standards allowed teachers to know what they should try to instill in each student in the course of the year. Similarly, Ms. Jensen seemed to think the attributes in the math practice standards tie in with what students need to know at each level of their development with respect to higher-order thinking skills [HOTS]. In tandem with Ms. Delaney and Ms. Jensen, Ms. Alexander explained:
To me, the role of these practices is to guide the teacher into guiding the students into becoming competent and proficient in math. Because these practices are universal in nature, they can relate to any and all content standards. These practices can help sustain the lesson and lead to [behaviors of] student ownership in understanding the standard and making his or her own application in real life.

As Ms. Jensen articulated, higher-order thinking skills are closely aligned to the skills embedded in the math practices. Higher-order thinking allows students to engage in problem solving by explaining, modeling, and generalizing. This conversation about the nature of the math practice standards indicated that participants were making connections between the new math practice standards and the older concept of higher-order thinking skills.

Just as there are relationships among the higher-order thinking skills, so too are there relationships among the math practice standards. During the study group sessions, participants reviewed a structure of the math practice standards diagram (Louisiana Department of Education, 2013b) that was included in the module 5 content. The diagram, shown in Figure 4.1, illustrates that Math Practices 1 and 6 are overarching habits of mind of proficient thinkers. As a result, these two practices: make sense of problems and persevere in solving them (MP1); and attend to precision (MP6), are strongly connected to all the other practices. The student characteristics and behaviors of mathematically proficient students in the remaining six practices fall into three categories: reasoning and explaining (MP 2, MP 3); modeling and using tools (MP 4, MP 5); and seeing structure and generalizing (MP7, MP8). This diagram was important to participants because they realized that they would need to help their students see these relationships as they engage in math performance tasks.

**Mathematical Knowledge for Teaching.** While the ideas behind the Standards for Mathematical Practice are not new, implementation of the practices are critical to implementation of the shift in rigor from the expectations for student performance in the grade level expectations under the Louisiana Comprehensive Curriculum to expectations for student
performance in the math content standards in CCSS. Participants discovered that it is through the Math Practices that students attain deep conceptual understanding, fluency and procedural skill, and application. Emphasizing the explicit teaching of the Math Practices is an example of the category of participant responses that focused on the shift in instruction.

Figure 4.1
Structure of the Math Practice Standards

For example when discussing MP 6—attend to precision—Ms. Alexander stated, “It drives me crazy when they [the students] don’t use them [unit names]. I remind them [the students] of that all the time.” Ms. Jensen concurred with Ms. Alexander by saying that “we have to start them [students] out on day one every year reminding them to be precise in their
solutions to problems by putting 10 lbs., 2 inches, and so forth.” Also other participants in the study group nodded their heads in agreement.

In addition to discussing shifts the math practice standards required in instruction, teachers also explored and discussed the resources they would need to increase their knowledge of the math practices and to apply that knowledge to designing tasks, lessons and units and being more facilitative in the classroom. They identified more videos of teachers teaching CCSS math lessons incorporating the math practices and an additional three modules on the CCSS math content standards. They reviewed sample yearlong curriculum maps, sample daily lesson plans, and guidance on how to set goals for student achievement related to the CCSS content standards. They determined that assessment guides were a way to clarify instructional and assessment shifts in how the state tests align to the new, rigorous standards. They discovered that all of these resources that will help them to build mathematical knowledge for teaching math were located on the Louisiana Department of Education’s website in the Teacher Support Toolbox (2013).

Ms. Delaney claimed she wanted to take time to review Bill McCallum’s Tools for the Common Core Standards Blog (2013) over the summer to get a deeper understanding of the changes in math. She ended her comments by saying, “I just need sufficient time to go deeper in the materials and resources presented during the study group meetings.” Ms. Steele talked about the state’s Teacher Leader Statewide meetings that she attended and said she could share more information with the teachers about the yearlong curriculum maps for each grade, sample unit plans, and the Backward Design planning documents for creating units and lessons. Team members realized through the module activities and their own discussion that the CCSSM practice standards will require shifts in their instruction and that there are people and material resources to help study groups make these shifts.
The other important category under the theme Mathematical Knowledge for Teaching is the CCSS math content standards. Ms. Steele stated during one of the study group sessions that the most powerful information to her was in Module 4 when the team discussed the verbs in the content standards being important, particularly when connecting the content to the Math Practices. Also focusing on the importance of verbs, Ms. Jensen said that she agreed with the statement that content standards that begin with the word “understand” are good opportunities to connect the Math Practices to the content standards by asking students to engage in mathematical reasoning as they explain concepts. The participants were practicing and understanding a key shift in the CCSS ELA standards, the requirement of close reading. They were closely reading the math content standards to focus on what students need to do.

The observation notes recorded revealed that participants indicated understanding—nodding in agreement by all participants—that the Standards for Mathematical Practice must be taught as carefully and practiced as intentionally as the Standards for Mathematical Content. Data revealed that participants generally felt that neither the content nor the practice standards should be isolated from the other; rather, that impactful mathematics instruction occurs when these two halves of the CCSSM come together in a powerful whole. Overall, participant responses to questions and their conversations in the sessions revealed that the goal of the standards is to develop mathematically proficient students and that this will require teachers to develop deep mathematical knowledge of both the practice and content standards and to apply this knowledge, in conjunction with the resources the state is providing, in shifting their approach to math instruction. The analysis of interview responses related to the third subordinate research question did not generate any codes that were outliers to the categories and themes described above.
Research Subordinate Question #4: Why is it important for teachers to better understand the Standards for Mathematical Practice in the CCSS?

The interview and written pre-/post-assessment written questions under the fourth and final subordinate questions were: a) Interview Question: How is the role of teacher when implementing the Math Practices different than the expected role of the past? and b) Focus Group/Assessment Question: What is the primary role of the student in implementing the Math Practices? After coding all of the individual and focus group interview responses line-by-line and examining responses to these questions, two themes were pinpointed: For teachers to better understand the Standards for Mathematical Practice in the CCSS, it is important to understand the teacher and student roles which require (1) a teacher-facilitated focus and (2) a student-driven focus. The themes and categories are shown in Table 4.7.

<table>
<thead>
<tr>
<th>Theme: Teacher-Facilitated Focus</th>
<th>Theme: Student-Driven Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
<td>Frequency</td>
</tr>
</tbody>
</table>

Teacher-Facilitated Focus. The primary role of the teacher with CCSS is to create lessons with performance tasks that permit students to develop the characteristics and behaviors of mathematically proficient students over time. The teacher’s role once the task has been given to the students is to act as a facilitator of learning by questioning, encouraging, monitoring, etc. thus generating a teacher-facilitated focus.
The first category under this theme, coach, guide, aide, is a compilation of terms synonymous with the new role of the teacher when implementing the Math Practices—facilitator, guide, coach, assistant, etc.—which is different than the expected role of the past, “the sage on the stage.” Ms. Jensen discussed that, “the role of the teacher, with the new math standards and practices, becomes the coach watching the students perform the tasks and only assists as needed to develop the concept. The teacher facilitates the learning process.” Ms. Collins also acknowledged the pivotal role of the teachers as she stated, “the teacher is becoming more of a facilitator role as the students use the math practices to learn the math skills.” Ms. Alexander then elaborated on what being a facilitator meant,

Implementing the Math Practices in the classroom will require giving students more opportunities for discovery learning, group learning, and designing real-life projects. The teacher becomes a facilitator. Without the practices, a teacher could rely more on direct instruction and rote [learning].

These comments by participants indicate that they believe it is important for teachers to better understand the math practice standards because the way they need to teach with the practice standards has to change from primarily using direct instruction to a more facilitative approach.

The second category under teacher-facilitated focus is what the teacher facilitates. The teacher will be responsible for both the new Common Core math content standards and the math practice standards. Ms. Delaney spoke briefly about teachers needing to understand the [math] practices in order to improve instruction in mathematics. She deliberated “I think in the past teachers were simply expected to teach the students the math concepts. With the math practices, teachers have a goal in mind that applies to all math and helps students build one concept after another.” Ms. Alexander corroborated Ms. Delaney’s comments as she reasoned on the importance of teachers really understanding the math practices, “You can’t teach what you don’t understand. If the teacher doesn’t understand or appreciate the practices, then she won’t incorporate them.” Ms. Jensen further supported this notion as she shared her thoughts that that uniformity [an equal balance
between content standards and practice standards] is an essential part of the teacher’s role. Ms. Steele summed up the primary role of the teacher with regard to teaching the CCSS math concepts in her written pre-assessment response to questions:

- The teachers are [now] expected to go more in depth about specific topics [than in the past role]. They no longer are bouncing from topic to topic [as they did in the past]. They [now] focus more with more of a purpose for their subject area.

Illustrating the crucial role of teachers as facilitators versus transmitters of knowledge was an important finding coupled with acknowledgment that math content and math practice were also necessary skill sets needed to teach the CCSS in mathematics. To illustrate this further, all three of the math teachers’ written post-assessment responses will close out this section below in the following order, Ms. Delaney, Ms. Jensen, and lastly Ms. Alexander:

- [First], the teachers were doing mostly direct instruction. Using national curriculum the teachers should be more facilitators of the instruction after teaching students the math practices in conjunction with learning the concepts.

- [Hence], the role of the teacher should be more facilitator than direct instruction. He/she should really strive for guided questioning to ensure student understanding. With adequate planning, the teacher should be able to structure groups of students to work together using various strategies—instead of “mimic”.

- [To conclude], now, the teacher will be more of a facilitator. Direct instruction will still be utilized but at a minimum. Students will be more verbal and vocal and be responsible for their own broadening of understanding and each others’ understanding. Teachers will have to be just as in “control”—if not more so—of the lesson than ever. Instead of being a detached “captain of the ship”, she will now be both captain and member of the crew.

Several key ideas emerge from the participant comments above. 1) the CCSS math practice and content standards require deep learning and application, not a superficial “mile-wide, inch-deep” approach; 2) teachers need to understand deeply the math practice and content standards they are expected to teach; 3) teachers must re-invent themselves as learning facilitators; and 4) being a learning facilitator is demanding work that requires a different type of classroom control and management.
**Student-Driven Focus.** With the role of the teacher changing from direct teaching to facilitating with the implementation of CCSSM, the students’ role also changes from receiving the math to “doing” the math. By “doing” the math students will become mathematically proficient students through the implementation of the Standards of Mathematical Practice. Therefore, this new change of roles demands a focus that is student-driven or in the simplest of terms, driven by the needs of students.

The first category under this theme describes how the students will learn the math. A powerful quote by Ms. Alexander highlighted this shift as she stated, “The student (and this may be hard for some of them) will HAVE TO become more responsible for their own learning.” In the written responses from the post-assessment, Ms. Wiggs, one of the leadership team members, noted:

Students will be active in their learning. They will be trained [by teachers] in a way that will be different from traditional learning in that they will engage in Pair-Share strategies and discuss among their peers by finding solutions to problems together.

The other leadership team member, Ms. Steele stated in the pre-assessment, “The students will become more familiar with the practices and learn what those practices mean so they are able to solve the problems more effectively and go deeper in content.” Some other terms used in the written assessments that described how students should function were “self-directed”, “responsible for own learning,” and “work with other students,” as well as “be their own teacher (in a sense),” and the phrase used that described students being able “to teach other students.” The message about how students will learn CCSS math that came through in these statements is that students will be actively engaged in their own learning in collaboration with other students, not just individual passive receivers of knowledge.

The second category under this theme, mathematically proficient, is described as characteristics and behaviors that students should obtain as they progress from grade to grade. Ms. Wiggs commented during one of the study group sessions that, “students continue to develop in their
mathematical understandings from year-to-year.” Her reference to “mathematical understandings” referred to both the characteristics and behaviors with regard to the math practice standards that teachers should expect in terms of growth.

The study participants also reviewed the mathematics progression documents for the mathematical practices in order to gain a better understanding of how this year-by-year progression might look. To help students gain an understanding of what the math practices mean, classroom posters for grades K-6 were given to each of the study participants as visual aids for their classrooms. Ms. Alexander communicated this progression as she commented on “how all of the vocabulary was different [from grade to grade] and progressed in degrees of difficulty over time as should mathematical proficiency in students.” These comments by participants reveal that their conception of the math practice standards broadened from thinking about them as fixed standards, or destinations, to thinking about them as developmental continua, or road-maps, that guide students’ progress toward being mathematically proficient. The analysis of interview responses related to the fourth subordinate research question did not generate any codes that were outliers to the categories and themes described above.

Implications for the Overarching Research Question:

The overarching research question for this study was: What impact has the professional learning from Whole-Faculty Study Group sessions had on teachers’ understanding the most significant contributions of the Standards for Mathematical Practice in preparation of the implementation of the Common Core State Standards in mathematics? In the following paragraphs, the different data sources were used to compare participant responses to the overarching research question.

Pre- and post-assessment written responses. One answer to this question lies in comparing participants’ individual written responses to the same two questions at the beginning
of this study and at the end. The two questions were: 1) How is the role of teacher when implementing the Math Practices different than the expected role of the past, and 2) What is the primary role of the student in implementing the Math Practices? As a result of the work the team did together during the four study group sessions, their perceptions of how the role of the teacher is different became more elaborate and more nuanced, as indicated in the participant responses that follow.

At the end of the study, when asked how the role of teacher is different when implementing the Math Practices than the expected role of the past, Ms. Wiggs, a Leadership Team member, had a clearer understanding of the shift in teacher roles. Her response in the pre-assessment was only “student-driven” but she was able to explain more in-depth on the post-assessment by writing:

The role of the teacher will differ from years in the past. The teacher will be more of a facilitator than just a lecturer. The teacher will shift a lot of responsibility to the students by having them “teach” each other.

Her responses indicated that student-driven meant that teachers need to be more facilitative and that students need to take more responsibility for their learning, including teaching each other using strategies such as “pair-share.”

Ms. Alexander, the fifth grade teacher, did not identify in her pre-assessment response a role for teachers in teaching the Math Practices, “the math practices are in terms of students achieving and not teacher-direct instruction.” But after the sessions, her post-response clearly described the teacher’s new role

Now, the teacher will be more of a facilitator. Direct instruction will still be utilized, but at a minimum. Students will be more verbal and vocal and be responsible for their own broadening of understanding and each others’ understanding. Teachers will have to be just as in “control”—if not more so—of the lesson than ever. Instead of being a detached “captain of the ship”, she will now be both captain and member of the crew.
The noted absence of a teacher role in her response initially, compared to her post-response, illustrated her sense that the teachers’ role was of paramount importance, a significant dispositional shift.

At the beginning of the study, Ms. Jensen, the fourth-grade math teacher, had some misconceptions about the shifts in the teacher role. She initially compared the new teaching role to that of a coach handing out plays to a team as she shared through this metaphor that, “The teacher should be the ‘coach’ giving the plays to be carried out or demonstrated by the students. Instead of the teacher just giving instruction.” She didn’t seem to understand that following plays are just more elaborate sets of instructions. In juxtaposition, in her post-assessment response, she shifts her thinking to incorporate students developing their own plays when she wrote,

The role of the teacher should be more facilitator than direct instruction. He/she should really strive for guided questioning to ensure student understanding. With adequate planning, the teacher should be able to structure groups of students to work together using various strategies—instead of “mimic”.

Similarly for the second question, what is the primary role of the student in implementing the Math Practices, team members’ perceptions of how the role of the student is different were more developed, advanced and established in the post-assessment responses. For example, on the primary role of the student in implementing the Math Practices, Ms. Wiggs in the pre-assessment simply stated, “learning” as opposed to her more detailed and articulated post-assessment response,

Students will be active in their learning. They will be trained in a way that will be different from traditional learning in that they will Pair Share [one of the strategies presented for engaging students] and discuss amongst their peers by finding problems and solutions.

Ms. Wiggs’ post-response clearly showed an understanding of the active role that students are expected to have as they use the math practices. Also implied in her post-response is the shift in the teacher’s role to train students to be more actively engaged in their learning.
In a similar fashion, Ms. Jensen progressed from her initial response, “persevering in problem-solving means that you keep working” to her post-response, “students should be able to work together and explain how they can have different ways to solve the problem,” clearly illustrated her shift in thinking. Ms. Alexander’s responses also documented this shift and delineated her expanded thinking about the students’ role from her initial response, “Self-directed as much as possible—investigative learning” to her post-response, “... student will be more verbal, vocal, attentive to precision, attentive to others, responsible for their own learning. This will be hard for some who are teacher-dependent, but change is inevitable and important for growth.”

These responses on the post-assessment questionnaire revealed that professional learning from the Whole-Faculty Study Group sessions had an impact on teachers’ understanding the most significant contributions of the Standards for Mathematical Practice in preparation of the implementation of the Common Core State Standards in mathematics. Through participation, these teachers appeared to more clearly see that teachers have to teach the math practices in ways that enable students to develop mastery of these practices, embed the math practices in student performance tasks, and model, use, and live the math practices in their actions and questions.

**Emerging themes from the subordinate research questions.** A second answer to the overarching research question about teachers’ understanding of the math practice standards lies in analyzing the themes that emerged from an analysis of participants’ responses to the interview questions for the four subordinate research questions. Here are the themes for each subordinate research question and why they are important for explaining the impact of the four study group sessions on teachers’ understanding of the most significant contributions of the math practices in the implementation of CCSSM.

The first subordinate question identified two themes: Teachers and administrators perceive the goal for collaboration in WFSGs is to (1) empower teachers and (2) establish
common goals among teachers. The participants developed a personal understanding of collaboration that empowered them to learn and share more effectively in their study group sessions.

The second subordinate question established two themes: Factors that promote collaboration in WFSG were a) having structures in place and b) resources to connect teacher actions to student outcomes. The participants’ understanding of collaboration also led to the identification of factors that inhibit or promote collaboration. As one leadership team member said, “It is a huge shift in practice to implement specific strategies [resources] that connect to the math practices.” In support of this idea, Ms. Collins added that consistency was essential to connecting teacher actions to student outcomes: “The consistency from teacher to teacher is key and can be accomplished through teacher collaboration.”

The third subordinate question generated two themes: The role of the Standards for Mathematical Practice in the CCSS is to (1) foster mathematical proficient students and (2) enhance mathematical knowledge for teaching. Team members all said they want students to become mathematically proficient. Ms. Alexander stated that the road leading there may be long, but the Standards for Mathematical Practice provide a clear image of what the destination looks like. She continued by adding,

As a math teacher, you may see lessons and consider to what extent they present opportunities for students to demonstrate the Standards for Mathematical Practice. Think, for example, about a lesson you have taught. How might the skills have been taught in a way to nurture the Mathematical Practices in students to become mathematically proficient? Also think about ways we can become more math knowledgeable at the same time as teachers.

The fourth subordinate question elicited two themes: For teachers to better understand the Standards for Mathematical Practice in the CCSS is to understand the teacher and student roles (1) teacher-facilitated focus and (2) student-driven focus. The math performance tasks that
the team examined during the study group sessions gave a glimpse of several Standards for Mathematical Practices in action. Team comments focused on what the students and teacher would be doing during the task. Ms. Steele remarked, “Students would be designing an approach to show whether the statement was true (which required perseverance or MP1].” While Ms. Jensen brought up the quantitative reasoning of the students [MP2], Ms. Delaney continued the conversation when she expressed that students would also be constructing viable math arguments [MP3]. Ms. Alexander closed out the discussion by commenting on the teacher’s role: “Certainly, the teacher’s facilitated focus plays a critical role. The teacher selected the task, set up the task, considered what mathematics content and practices related to this topic, determined the questions to ask, and monitored students.” The teachers realized that a student performance task might encompass several math practices.

This team discussion demonstrated that professional learning during the Whole-Faculty Study Group sessions had an impact on teachers’ understanding the most significant contributions of the math practices in ways that focus on what students need to know and be able to do. The CCSSM requires students to be able to demonstrate the Mathematical Practices. Ms. Collins, the executive director, expressed that the learning from the study group sessions is a good place to begin having conversations together as teachers work collaboratively, such as, “What does math practice three [construct viable arguments and critique the reasoning of others] look like in action?”

**Records and observation notes.** A third answer to the overarching research question about teachers’ understanding of the math practice standards lies in analyzing the records and observation notes to ascertain the impact of the four study group sessions on teachers’ understanding of the most significant contributions of the math practices in the implementation
of CCSSM. The analysis of participant comments recorded in the observation notes and the study group meeting logs indicated that participants better understood the math practices in the Common Core Standards as a result of engaging in the three modules during their study group sessions. For example, notes in the study group log for the second session indicate that members were becoming aware of the importance of the math practices, “implementation of practices are critical to the shift of rigor [in the CCSSM]” and “it is through SMP [the math practices] that deep conceptual understanding, fluency, and procedural skill, and appreciation are attained.” The observation notes revealed that Ms. Alexander commented on building a community of proficient math learners by shifting from students working individually toward a community of learners implementing the mathematical practices. She stated, “a math community in a classroom is where we will begin to hear more sharing among students in regards to reasonable solutions to tasks.” This comment by Ms. Alexander signaled an important shift in thinking about the role of the teacher with regard to the CCSSM practice and content standards – that there may be several reasonable ways of solving a problem, rather than only the teacher’s way.

Data captured in the study group action plan, meeting logs, and observation notes indicated the learning and building of teacher capacity through identifying, discussing, and understanding the instructional practices critical to the math practices. The study group time and structure provided the team members support and the collective accountability for the preparation to begin implementation of the eight math practices. Team members realized that increases in student learning required increased teacher learning. Both Ms. Jensen and Ms. Delaney discussed the shift from content taught in isolation toward teacher-facilitated content presented with explicit attention to making connections among mathematical practices. Ms. Jensen exemplified this when she stated, “it is going to be difficult for teachers to let go and allow this gradual transition of more student-centered work to take shape.”
Summary

The major findings from this study were compiled from the collaborative voices of both teachers and administrative staff as they reflected on their participation in Whole-Faculty Study Group sessions to learn about the Standards for Mathematical Practice and their role in the implementation of the Common Core State Standards in Mathematics. Their reflections were guided by the interview questions that focused on the four subordinate research questions in this study. The following are synthesis statements condensing what they said in response to each question:

1. What do teachers and administrators perceive as the goal(s) of collaboration in Whole-Faculty Study Groups (WFSG)?

   Teachers and administrators perceive the goal for collaboration in WFSGs is to empower teachers and establish common goals among teachers. Team members developed a personal understanding of collaboration that empowered them to learn and share more effectively in their study group sessions.

2. What factors inhibit or promote collaboration in a WFSG?

   Factors that promote collaboration in WFSG were having structures in place and resources to connect teacher actions to student outcomes. Factors that inhibit collaboration were insufficient time, lack of clarity about expectations for collaboration, and the absence of mutually agreed team norms.

3. What is the role of the Standards for Mathematical Practice in the Common Core State Standards for mathematics (CCSSM)?

   The role of the Standards for Mathematical Practice in the CCSS is to foster mathematical proficient students and enhance mathematical knowledge for teaching.
4. Why is it important for teachers to better understand the Standards for Mathematical Practice in the CCSSM?

For teachers to better understand the Standards for Mathematical Practice in the CCSS is to understand the shifts in teacher and student roles that require a teacher-facilitated focus and the active engagement of students in their own learning through a student-driven focus.

The analysis of data from these study group sessions and from interviews provided evidence of the positive impact that teacher collaboration had on increasing teachers’ understandings of the most significant contributions of the math practices in preparation of the implementation of the CCSM – the overarching research question for this study. After participation, it is apparent that team members better understood the math practices, the role of teachers and students in using these practices, how to embed these practices in student performance tasks, and how to connect the practice standards with the CCSSM content standards, all crucial findings. Given the importance of two factors, math knowledge, including content and practice and the role of teachers, these are important findings about how one school addressed the need to be knowledgeable about CCSSM and how to build proactively teacher capacity around the teaching of math. While these findings cannot and should not be generalized to larger populations, the implications for practice are clear.

The subsequent and final chapter of this dissertation interprets the findings of the study presented in this chapter in the context of the literature review presented in chapter two. It also makes recommendations for future action by Bellamy Charter School, other schools preparing for CCSS implementation, and policy makers, discusses the implications of this study, and suggests opportunities for further research.
CHAPTER 5: CONCLUSIONS, INTERPRETATIONS, AND RECOMMENDATIONS

Introduction

This case study explored whether a team of teachers who participated in the study, a six week Whole-Faculty Study Group, would be prepared to transition to the CCSS in mathematics in the fall of the 2013-14 school year with full implementation of standards and assessments—Partnership for Assessment of Readiness for College and Careers (PARCC 2011)—the following 2014-15 school year. The overall guiding question of the research was: What impact has the professional learning from Whole-Faculty Study Group sessions had on teachers’ understanding the most significant contributions of the Standards for Mathematical Practice in preparation of the implementation of the CCSS in mathematics? The subordinate research questions in this study were:

1) What do teachers and administrators perceive as the goal(s) of collaboration in Whole-Faculty Study Groups (WFSG)?

2) What factors inhibit or promote collaboration in a WFSG?

3) What is the role of the Standards for Mathematical Practice in the Common Core State Standards for mathematics (CCSSM)?

4) Why is it important for teachers to better understand the Standards for Mathematical Practice in the CCSSM?

Analysis was conducted based on Yin’s four suggested strategies: “relying on theoretical propositions, developing a case description, using qualitative and quantitative data, and examining rival explanations” (2009, pp. 130-134). Mindful of Yin’s recommendations, I followed this process during the case-study analysis of data related to the four subordinate questions. In particular, the tenets of WFSG were considered and used as a theoretical
underpinning throughout data collection, analysis, and write up of results. Great care was taken to develop a case description that was rich in detail and offered an adequate portrait of the school and participants who functioned as the single case. Three distinct data sources were used: interviews, a questionnaire, and observations. A combination of a focus group interview with teachers, semi-structured individual interviews with select teachers, a formal interview with the principal, and a pre- and post-assessment written questionnaire were conducted. Observations were conducted at the WFSG meetings, providing ample qualitative data. In an attempt to examine rival explanations, pre- and post-assessment written responses were compared, comparing participants’ individual written responses to the same two questions at the beginning of this study and at the end. Overall, all data sources were used to achieve triangulation. Additionally, team and school level documents were considered in the analysis phase of this study.

Themes were developed by carefully coding and then analyzing the code responses from the focus group interview of three teachers and two administrative leadership team members and from the individual interviews with math teachers and administrator, as well as coding and analyzing written responses from participants to a pre- and post-written assessment. Data were coded using in vivo coding for the initial cycle which is a coding method that safeguards the actual language of participants and helps to ensure that the participants’ voices are respected (Saldana, 2009). Subsequent merging of coding was carried out using pattern coding which facilitates populating major themes and examines patterns in human relationships and social networks (Saldana, 2009). Themes emerged from data that were coded in relation to each of the four subordinate research questions. The themes were established during careful analysis. The findings of the study were the themes that emerged from data analyses.
Conclusions

This study is important for its setting, its framework for the professional learning intervention, and its focus on the Common Core State Standards. The setting for this is important because the setting was a rural start-up charter school in north Louisiana. There has been very little research done on teaching and learning in charter schools in Louisiana and none on rural charter schools. Second, the framework for this professional learning intervention was the Whole Faculty Study Groups system for schoolwide teacher collaboration. A key focus of this study was whether teachers working collaboratively in a WFSG study group perceived the benefits of successful collaboration as they engaged together in the content. Third, this study is important because the content of the work was teachers developing an understanding of, and an appreciation of, the significance of the new Standards for Mathematical Practice in the Common Core State Standards in Mathematics. Case study research into how teachers learn about and use CCSSM content and practice standards is one of the priority case research areas identified by Horizon Research as part of a National Science Foundation funded project on the development of a research agenda for understanding the influence of the Common Core State Standards for Mathematics (Heck, Weiss, & Pasley, 2011, p. 14).

This chapter interprets the findings of the study presented in chapter four in the context of the literature review presented in chapter two. It also makes recommendations for future action by Bellamy Charter School, other schools preparing for CCSS implementation, and policy makers, discusses the implications of this study, and suggests opportunities for further research.
Interpretation of Findings

Research Subordinate Question #1: What do teachers and administrators perceive as the goal(s) of collaboration in WFSG?

The interview questions under this subordinate question were a) Individual Interview Question: What is needed for successful collaboration? and b) Focus Group Interview Question: How do you utilize collaboration to achieve your vision? Two themes were identified in the data analysis described in chapter four: Teachers and administrators perceive the goal for collaboration in WFSGs is to (1) empower teachers and (2) establish common goals among teachers. Interpretation of findings is presented here according to those themes.

**Theme 1: Empower Teachers.** This theme is supported in the literature. Murphy & Lick (1998, 2001, 2005) as presented in the literature review in chapter two, discussed teachers’ participation in study groups and stated that teachers generally gain self-confidence and feel confirmed in study groups, which leads to the empowerment of teachers. Roberts (2007b, p. 122) reported that in the Learning Intensive Networking Communities for Success (LINCS) program the Whole Faculty Study Group process led to “the empowerment of teachers, bringing about mathematics improvement according to the student needs.” Similarly, Urbanski and Castillo (2007, p. 46-47) described the WFSG system as “good professional development” [that is] “inseparable from the day-to-day work that teachers do: job-embedded, teacher-driven, and centered on the work of their current students.” Learning Forward (2011, p. 28) also supports empowering teachers by recognizing in its leadership standard the importance of distributed leadership with teachers engaged in a variety of formal leadership roles, such as instructional coaches, and informal roles, such as leaders in their learning communities. DuFour, DuFour, Eaker, and Karhanek (2004) state that schools implementing the PLC Model have clarity of purpose and a collaborative culture, are able to turn collective inquiry into a best practice and
examine current reality, are action oriented and committed to continuous improvement, and have a strong principal who empowers teachers. Data revealed that the process of participating in a WFSG empowered participants.

**Theme 2: Establish Common Goals among Teachers.** This theme is supported in the literature presented in chapter two as well. Guskey (1995) reported that working in teams helps focus attention on the shared purposes and improvement goals that are the basis of the professional development process in that context. DuFour (2011) stated the purpose of collaboration in PLCs is to improve professional practice and the learning of students. Reichstetter (2006) found that PLCs promote results-oriented thinking that is focused on continuous improvement and student learning. He also notes that collaboration provides a mechanism for sharing responsibility for student learning and a means to work together toward a common purpose.

Whole Faculty Study Groups also have a common goal in improving student learning. Murphy, the founder of the WFSG system says the essential question that guides WFSGs is “What are students learning and achieving as a result of what teachers are learning and doing in WFSGs?” (Murphy and Lick, 2005, p. 2). Every teacher in every study group sets student learning goals for their students for the common student learning needs that the group has decided to address. These student learning goals, and the target date, are listed in the group’s action plan. Each study group is expected to engage in cycles of action research to plan and implement classroom interventions to improve student learning and to monitor through common classroom assessments their students’ progress toward these goals (Clauset, Lick, and Murphy, 2008).
In the WFSG system, professional learning is embedded in the cycles of action research in which study groups engage over the course of the school year. This is the learning that Murphy refers to in her guiding question. Teachers engage in learning together about the research and content related to the student learning needs their students need for them to address, the research-based instructional strategies for engaging their students in improving their learning, and strategies and tools for assessing change in student learning (Clauset, Lick, & Murphy, 2008).

In the first year of implementing the WFSG system, study groups operate at two levels. The first level is to engage in cycles of action research to improve their practice and to improve student learning. The second level is learning how to collaborate together effectively and how to engage in cycles of action research.

In this study, the Bellamy Charter School pilot study group did not have time to engage in a full cycle of action research, but they did operate at two levels. The study group’s primary common goal was to learn about the Standards for Mathematical Practice to prepare for CCSSM implementation. Their secondary common goal was to support each other in learning about the math practice standards and to learn how to collaborate together effectively.

**Research Subordinate Question #2: What are factors that inhibit or promote collaboration in WFSG?**

The interview questions under this subordinate question were a) Individual Interview Question: What expectations for meetings encourage collaboration? and b) Focus Group Interview Question: What systems, resources, and relationships support collaboration? Two themes were identified in the data analysis in chapter four: Factors that promote collaboration in WFSG are (1) having structures in place and (2) connecting resources.
**Theme 1: Structures in Place.** Participants in this study clearly indicated in interviews and observations that collaborative structure, as defined by a time and space set aside for teachers to work together, provided important and valued opportunities for teachers to engage in job-embedded professional learning and implement cycles of action research to improve student learning. Within this theme, participants also referred to the importance of deliberate, intentional, an conscious organization of group members, clear schedules that protected time for regular study group meetings, facilitation and a shared responsibility for the work of the study group, and clear expectations as crucial to their understanding of the CCSSM. The literature reviewed in chapter two also supports the participants’ assertion that having supportive structures in place promotes teacher collaboration and job-embedded professional learning.

The WFSG Guidelines (Murphy & Lick, 2005, p. 87) describe the key contextual factors and process behaviors that an individual study group addresses and that the schoolwide WFSG system exhibits. These guidelines, shown below, relate to the participants’ categories of deliberate organization, schedule/time, facilitation/shared roles, and expectations/norms.

1. Determine study-group membership by who wants to address a set of data-based student needs identified through a process that involves the whole faculty.
2. Keep the size of the study groups between three and five members.
3. Establish and keep a regular schedule, meeting weekly or every two weeks.
4. Establish group norms and routinely revisit the norms.
5. Establish a pattern of study-group leadership, rotating among members.
6. Develop a study-group action plan by the end of the second study-group meeting.
7. Complete a study group log after each study group meeting.
8. Have a curriculum and instructional focus that requires members to routinely examine student work and observe students in classrooms engaged in instructional tasks that are a result of the study group’s work.

9. Use a variety of learning resources, both material and human, that serve as the ‘expert voice’ to the learners.

10. Use multiple professional-development strategies, such as training, to accomplish the study group’s intended results.

11. Reflect on the study group’s work and the impact of current practice on student performance.

12. Recognize all study-group members as equals.

13. Expect transitions or shifts in the work.

14. Assess study-group work to determine what evidence there is that the targeted student needs have been improved.

15. Establish a variety of communication networks and strategies.

Not surprisingly, the participants’ statements about necessary supportive structures after only four study group meetings are not as encompassing as the WFSG guidelines that were designed to support full implementation of the WFSG system in a school. However, data also revealed that participants had begun to realize the importance of several of these components, particularly guideline 3, (establishing and keeping a regular schedule), guideline 7, (completing a study group log), guideline 8, (having a curriculum and instructional focus that required members to routinely examine student work and the perceived need to observe students in classrooms engaged in instructional tasks related to the study group’s work), and guideline 9,
(utilizing a variety of learning resources, both material and human, that serve as the ‘expert voice’ to the learners).

The literature on PLCs also supports the importance of having structures in place. Reichstetter (2006) identified three critical components necessary for facilitating and sustaining PLCs: supportive leadership; collective learning; collaborative teamwork and decision making. Reichstetter further describes a PLC as team members who regularly collaborate toward continued improvement in meeting learner needs through a shared curricular-focused vision. DuFour (2011, p. 61) concurs and says

In order to establish schools in which interdependence and collaboration are the new norm, we must create the structures and cultures that embed collaboration in the routine practice of our schools, ensure that the collaborative efforts focus on the right work [improving professional practice and student learning], and support educators as they build their capacity to work together rather than alone.

Learning Forward, in its standards for professional learning (2011), expects all educators to work in learning communities “committed to continuous improvement, collective responsibility, and goal alignment.” In its resources standards (2011, pp. 33), it expects that there is “dedicated job-embedded learning time” for learning communities and professional learning. Despite the abbreviated duration of the WFSG, participants indicated the need for dedicated job-embedded learning times and for collaboration among faculty. In addition, having the principal as a partner in learning emerged as an important leadership role.

**Theme 2: Connecting Resources.** During the study, participants continually came back to accessibility of shared resources as a key ingredient for successful collaboration. To them, this meant accessibility to material resources, such as the materials and videos about the math practice standards, and resources that connect teacher actions to student outcomes, such as examples of exemplary student work. It also meant assistance from peers and leadership team
members. A second key ingredient within this theme was teachers examining student work together to determine strengths and/or weaknesses against exemplars and then deciding what teachers needed to do with students to improve student learning.

Both of these components of connecting resources that were identified by participants are supported in the literature. The literature review revealed that successful efforts to improve the teaching and learning environment occurred when professional development was ongoing, job-embedded, data-driven, and collaboratively and collegially supported (Bolam et al., 2005; Kruse, Louis, & Bryk, 1995).

These findings are consistent with the cycles of action research in the Whole Faculty Study Groups system. The steps in the action research cycle are

1. Assess needs and establish baseline and target performance
2. Research content and best practices and develop expertise
3. Plan interventions
4. Implement interventions and monitor
5. Look at student work and data, assess changes, and decide the next step

Step 2, research content and best practices and develop expertise, involves identifying and using material resources, including exemplars, to support the group’s learning and interventions. The WFSG design also expects team members to see each other as resources and to seek assistance from other people within the school and outside it (Murphy & Lick, 2005, pp. 157-158).

Step 5, look at student work and data, assess changes, and decide the next step, has at its heart examining student work together using protocols to keep the discussion focused and non-threatening (Clauset, Lick, and Murphy, 2008, pp. 72-78). Clauset et al. also emphasize the
importance of study groups using common classroom assessments to collect student performance data and to analyze the data for changes in student learning.

The WFSG design expects the principal and the school leadership team to champion, lead, guide, and strongly support the system of faculty study groups. Some of the expectations for the principal’s role in leading and supporting the implementation of WFSG include:

- Advocate for, and legitimize the study group process.
- Ensure that there is time for group meetings and protect that time.
- Participate actively in training and planning sessions.
- Receive the Action Plans and Study Group Logs, and responding to them.
- Initiate procedures for the study groups to assess the progress of their work, and use the assessment information to strengthen their work.
- Help to identify expertise—both from staff inside the school and from outside sources—that can be used to support study group work.
- Facilitate Instructional Council meetings or other structures to shared the work of study groups.
- Communicate about study groups to district leaders, parents, and the general community.
- Participate in an Administrative Study Group (Clauset et al., 2008).

As is typical in schools just beginning the WFSG process, the participants’ statements about supportive leadership focused on the executive director providing time for study group meetings and ensuring that the time was protected and participating in training and planning sessions. While limited in scope, they indicate the recognition of the role of leadership in professional learning.
The Learning Forward standards for professional learning (2011) also call for strong leadership for job-embedded professional learning, learning communities engaged in cycles of continuous improvement that includes the collaborative analysis of student work, and access to shared resources and data. The Learning Forward cycle of continuous improvement for learning communities (2011, p. 24) is similar to the WFSG cycles of action research and is characterized by these steps:

- The use of data to determine student and educator learning needs.
- Identification of shared goals for student and educator learning.
- Professional learning to extend educators' knowledge of content, content-specific pedagogy, how students learn, and management of classroom environments.
- Selection and implementation of appropriate evidence-based strategies to achieve student and educator learning goals.
- Application of the learning with local support at the work site.
- Use of evidence to monitor and refine implementation.
- Evaluation of results.

DuFour echoes this focus on the continuous improvement work that collaborative teams do when he states that the “right” work for PLCs in a school is to:

work collectively to develop a guaranteed and viable curriculum to ensure that students have access to the same essential knowledge and skills regardless of the teacher to whom they are assigned. The team gathers ongoing information regarding the learning of their students through a comprehensive, balanced assessment process that includes common formative assessments developed by the team. The team then jointly analyzes the evidence of student learning from the assessments and uses the information to improve the professional practice of individual members and collective effectiveness of the team. As members look at actual evidence of student proficiency in the knowledge and skills the team has deemed essential, on an assessment the team has agreed is valid, they are able to learn from one another and continually enhance their ability to meet the needs of their students (2011, p. 61).
The pilot study group at Bellamy Charter School had only just begun the continuous improvement process that Learning Forward, the WFSG system, and the PLC design articulate, given the abbreviated six week duration of this study. However, the participants’ statements about connected resources indicate that they could see where their collaboration could take them and their students. This finding indicated the growing awareness of the necessity of a continuous improvement process.

**Research Subordinate Question #3: What is the role of the Standards for Mathematical Practice in the CCSS?**

The interview questions under this subordinate question were a) Interview Question: How do these Practices relate to math content standards? and b) Focus Group Question: What might be the result if you focus on these Practices in isolation of the math content standards? Two themes were identified in the data analysis described in chapter four: The role of the Standards for Mathematical Practice in the CCSSM is to produce (1) mathematical proficient students, and enhance (2) mathematical knowledge for teaching.

**Theme 1: Mathematical Proficient Students.** The attributes of professional learning communities gleaned from the literature review from both the PLC at Work and the WFSG designs, as presented in chapter two, include having shared values and vision (e.g., focus on student learning, high expectations for teachers and students, shared vision for teaching and learning) (Hord, 1997; Hord & Sommers, 2008). A deeper understanding of the eight mathematical practices enabled the teachers and leaders in this study to envision what it means for their students to be mathematically proficient. Embedded in the CCSSM mathematical practices are high expectations for how teachers and students think about and use mathematics, a vision of what good teaching and learning in mathematics is, and a focus on both what tasks students do and how they engage in these tasks. Schifter (2001) has reminded the mathematics
education community that additional mathematical skills needed for teaching may evolve not from a focus on mathematical content but from

attending to the mathematics in what one’s students are saying and doing, assessing the mathematical validity of their ideas, listening for the sense in children’s mathematical thinking even when something is amiss, and identifying the conceptual issues on which they are working. (p. 131)

Although the CCSS Mathematical Practices are not content as such but rather behaviors of interacting with the content, they cannot exist in isolation of the CCSSM content standards. Planning for instruction, therefore, must concurrently engage purposeful consideration of the mathematical content goals and of how the CCSS Mathematical Practices can be implemented during instruction to aid students in developing mathematical proficiency of the content standards (Larson et al, 2012, p. 60). It was clear that participants understood this precept.

**Theme 2: Mathematical Knowledge for Teaching.** Another important characteristic gleaned from both the PLC at Work and the WFSG designs included collective learning and application to practice (e.g., sharing information, seeking new knowledge and skills, working collaboratively, and applying the learning to their classroom practice) (Hord, 1997; Hord & Sommers, 2008). All participants understood that the Standards for Mathematical Practice must be taught as carefully and practiced as intentionally as the Standards for Mathematical Content. For the participants, mathematical knowledge for teaching meant, by the end of the study, both knowledge of the content standards and knowledge of the standards for math practices. Neither content or practice should be isolated from the other; impactful mathematics instruction occurs when these two halves of the CCSSM come together in a powerful whole. The participants understood what the CCSSM developers intended. “Designers of curricula, assessments, and professional development should all attend to the need to **connect the mathematical practices to mathematical content** in mathematics instruction.” (CCSSM, p. 8; emphasis in original)
The participants’ perceptions of the role of the Standards for Mathematical Practice in the CCSSM compare with what the CCSSM developers and math education community advocate. Strong effects on student achievement occur when the professional learning is focused on enhancing teachers’ [mathematical] knowledge [for teaching] of how to engage in specific pedagogical skills [standards for mathematical practice] and how to teach specific kinds of [math] content in order to enhance student learning (Blank, de las Alas, & Smith, 2007). The most effective professional development engrosses teachers in collaboratively studying, in a structured way, the very curriculum they will teach [CCSS math standards], as well as their students’ acquisition of that curriculum [through the Standards of Mathematical Practice]. This approach ultimately leads more teachers to adopt curricular and instructional innovations (Huggins, Scheurich, & Morgan, 2011; Penuel, Fishman, Yamaguchi, & Gallagher, 2007; Wayne, Kwang, Zhu, Cronen, & Garet, 2008). It was clear that participants in this study valued professional learning that was focused on enhancing participating teachers’ mathematical teaching knowledge and specific mathematical pedagogical skills as it translated to perceived enhanced student learning outcomes.

**Research Subordinate Question #4: Why is it important for teachers to better understand the Standards for Mathematical Practice in the CCSS?**

The interview questions under this subordinate question were a) Interview Question: How is the role of teacher when implementing the Math Practices different than the expected role of the past? and b) Focus Group Question: What is the primary role of the student in implementing the Math Practices? Two themes were identified in the data analysis described in chapter four: For teachers to better understand the Standards for Mathematical Practice in the CCSS, it is important to understand the teacher and student roles which require (1) a teacher-facilitated focus and (2) a student-driven focus.
Theme 1 Teacher-Facilitated Focus. If CCSSM implementation is to be more than a superficial action in schools or districts—more than a content standards mapping—more than compliance to yet another initiative—and is instead, intended to result in real improvements in student learning to close achievement gaps, then implementation efforts need to be more about instruction—how teachers approach student learning of the content standards (CCSS, 2010). As Wiliam contends, “Pedagogy trumps curriculum. Or more precisely, pedagogy is curriculum, because what matters is how things are taught, rather than what is taught” (2011, p. 13). According to the CCSS, “The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students” (NGA & CCSSO, 2010, p. 6). A teacher’s ultimate goal is to equip students with the particular expertise, the math practices, that will help them be successful across the mathematics curriculum and at every level of their mathematics learning (Larson et al, 2012, p. 60). Larsen also states that teachers should create classroom cultures that extend beyond traditional, teacher-centered instruction to facilitate students’ engagement in mathematics learning as they apply the math practices and interact with their fellow students (p. 25).

This image of teacher-facilitated learning in classrooms was consistent with the statements by participants in this study on the importance of a teacher-facilitated focus on the Standards for Mathematical Practice. Through participation in the WFSG, they exhibited that they had to be facilitators of knowledge, a new view for some of their teaching role.

Theme 2 Student-Driven Focus. The CCSSM includes content standards for developing student understanding as well as standards for student proficiency in their mathematical learning experiences. Mathematically proficient students merge their knowledge of math content with their ability to apply that knowledge to solve problems, communicate math
ideas, justify solutions, model math concepts, and reason to make sense of mathematics. In addition, “The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students” (NGA & CCSSO, 2010, p. 6).

The participants in this study enhanced their understanding of the mathematical practices in the Common Core Standards. They articulated that the students’ primary role is to apply the math practices as they perform the math. The primary role of the teacher then, is to develop lessons with tasks that allow students to develop the attributes and behaviors of mathematically proficient students over time. The teacher’s role once the task has been presented to students is to act as a facilitator of learning by questioning, encouraging, monitoring, and adjusting what they teach. Participants indicated an increased understanding of how they could facilitate learning through use of questioning, encouraging, monitoring, and adjusting what they teach.

The CCSS Mathematical Practices describe what students should be doing as they learn the CCSSM content standards. How should students engage with that mathematics and interact with their fellow students? By creating a classroom culture that extends beyond traditional, teacher-centered instruction, teachers can successfully facilitate students’ engagement in mathematics learning that leads to proficiency in the CCSSM content and practice standards (Larson et al, 2012, p. 25).

The participants’ perceptions of the importance for teachers to better understand the Standards for Mathematical Practice in the CCSSM compare with what the math education community says in regards to what students should learn. The work of teacher PLCs engaged in implementing the CCSSM content and process standards focuses on designing their collaborative
practice around four fundamental agreements (DuFour, DuFour & Eaker, 2008). The four agreements are:

1. What students should learn—clarifying the essential student learning clusters and outcomes—including *how* students learn the what, the math content standards, through engagement with the CCSS Mathematical Practices learning processes.

2. The development and use of common and coherent assessments to determine if students have learned the agreed-on curriculum—*how* will you know if students are learning?

3. How to collectively respond in class and out of class when students do learn the agreed-on curriculum of the CCSSM.

4. How to collectively respond in class and out of class when students do not learn the agreed-on curriculum on the CCSSM.

In order for collaborative mathematics teams to respond to these four professional learning community agreements with regard to teacher and student roles: time, access, support, and accountability for the teams to do their work must be provided. This understanding appeared to be at an initial stage with participants, perhaps due to the abbreviated WFSG timeframe used in this study.

**Recommendations**

This study explored one math study group’s professional learning from Whole-Faculty Study Group sessions and the impact of that learning on teachers’ understanding of the most significant contributions of the Standards for Mathematical Practice in preparation of the implementation of the Common Core State Standards in mathematics. This section presents recommendations that the Bellamy Charter School might consider as it involves the entire faculty in Whole Faculty Study Groups and in the implementation of both the Common Core
Content and Practice Standards in mathematics and the Common Core standards in English Language Arts. While these recommendations are specific to Bellamy, these recommendations would also apply to other schools establishing teacher collaboration teams to support the implementation of CCSS and to state policy makers charged with the implementation of Common Core Standards, job-embedded professional learning for teachers, and enhanced teacher collaboration.

**Recommendations for Bellamy Charter School**

The following four recommendations are made with the unique individuals who are employed at Bellamy in mind. These recommendations take into account, personalities, knowledge bases, working relationships, and the leadership displayed by the building principal.

1. Foster more teacher collaboration by implementing the WFSG design schoolwide under the leadership of an expanded leadership team that includes the math teachers participating in this study.

   Having shown that the teachers in the pilot study group could collaborate successfully to increase their understanding of the CCSSM math practice standards, the school should build on this success to launch schoolwide collaboration using the WFSG design during the 2013-14 school year. These study group members have the skill and confidence to become part of a leadership team that leads the faculty in establishing job-embedded learning teams for the entire faculty.

   Key factors in fostering more teacher collaboration that were identified in this study were having job-embedded time available and protected within contract hours, a deliberate and transparent plan for organizing teams, and clear expectations about how teams operate and what they accomplish.

2. Engage all math teachers in collaborative learning about the CCSSM practice and content standards.
The comparative analysis of participant responses before and after the study group sessions clearly demonstrated their increased understanding of the math practice standards. The teachers of this study mentioned that all math teachers needed to engage with the practice standards as they did and wanted to continue meeting collaboratively as math teachers. They added that they would also like to work more closely with other math teachers in the other grades to discuss curriculum alignment and student learning needs. The school leadership team should work with the math teachers to develop and implement a plan to enable this collaborative learning.

3. Engage all teachers in learning about the CCSS content standards in mathematics and ELA.

The math teachers indicated they really wanted to know ELA curriculum materials for CCSS as well as the math CCSS. This suggests that the school explore strategies to ensure that all faculty members need to understand the key features of the CCSS math and ELA standards and the shifts in instruction and in the teacher and student roles that each requires.

4. Develop (or modify) a schoolwide plan for the implementation of CCSS in math and ELA that incorporates the work of teacher collaboration teams.

The challenge with creating structures for teacher collaboration, as the three recommendations above suggest, is that faculty can become overloaded if they are expected to be full, active members of more than one collaborative teacher team working to implement the CCSS standards. Clauset, Murphy and Lick (2008) recommend in the implementation of the WFSG design that teachers choose only one study group or PLC to join for deep learning, inquiry, and action in weekly or bi-weekly meetings. This means using other structures, such as faculty meetings, or grade-level meetings for other types of professional learning and collaboration. The school leadership team, in consultation with the faculty, should develop a schoolwide plan for
learning about and implementing the CCSS standards that is aligned with the school’s culture and context, builds on the expertise of the faculty, and utilizes national, state, and regional resources.

**Recommendations for other schools**

Schools elsewhere in Louisiana, or in other states, may or may not be at the same point as Bellamy Charter School with regard to (1) having established an effective system for job-embedded teacher collaboration, and (2) the implementation of the CCSSM content and practice standards. This study suggests that other schools should first assess their current practices regarding teacher collaboration to ensure that teachers are fully engaged in meaningful work that leads to measurable changes in teacher practice and student learning and that teams have the structures, resources, and active leadership support that they need to be effective. If the current system of teacher collaboration does not meet these criteria, then the school’s leadership team needs to develop and implement a plan to create an effective structure or modify the existing system.

Similarly, school leadership teams should examine (1) the current level of understanding among faculty and leaders about the CCSS standards and the shifts in instruction and in teacher and student roles required by the standards, (2) the level of training teachers have had for implementation of the standards, and (3) the extent to which scope and sequence charts, curriculum maps, unit plans, lesson plans, assessment tools, and instructional resources have been identified, developed, and adopted for use by teachers. Based on the baseline data collected, the school’s leadership team needs to develop and implement a schoolwide plan to address deficient and move the school forward in its implementation of the CCSS standards.
Recommendations for leaders in the field and policy makers

This study has clearly indicated the positive impact of teachers working together collaboratively to make meaning of the CCSS Standards for Mathematical Practice. It has also shown that the Whole Faculty Study Group process for teacher collaboration could be a viable model to support statewide implementation of CCSS math practice and content standards.

An important revelation for the participants was that implementing the math practice standards is not “business as usual,” but involves significant changes for teachers and students. The challenge for educational leaders and policy makers is how to ensure that teachers have the time and support they need work together collaboratively to:

- learn about the CCSS standards,
- develop new or revised units, lesson plans, and classroom assessments that are aligned with the standards,
- change what they teach and how they teach to support the standards,
- set specific goals for improving student learning, and
- develop and implement strategies to ensure that all students improve.

Equally important is the need to provide time and support for principals, assistant principals, central office staff, and state department of education staff to learn about the CCSS standards and the implications for their work. This is a crucial recommendation as many principals and district as well as state level administrators lack deep knowledge of these standards, yet they are charged with implementation.

Final Researcher Reflections

This dissertation documents my learning expedition. I began the qualitative research process eagerly, thinking I would create the research, and fully expecting to finish it quickly. I
ended the process wondering where the years went, knowing the research changed me, and fully respecting the research process. I experienced a multitude of confidence and anxiety crises and finally accepted the challenge, which led to new learning—the real intention of this dissertation. I learned a great deal more about teacher collaboration and Whole-Faculty Study Groups, but learned more about myself in making a commitment and sticking to it, and I felt empowered as a result to help even more people learn about the Whole-Faculty Study Group process.

This dissertation study also has had implications for my current position as a deputy network leader for the Louisiana Department of Education. Through my work as a participant with the pilot study group, I realized the importance of providing multiple ways for engaging teachers with new content such as the CCSS math practice standards and that it is not enough to simply hand one of the state’s CCSSM modules to teachers and expect them to learn it and apply it overnight. The experience also reinforced for me the importance of establishing relationships with school leaders and involving them in the learning process.

I initially framed the writing of the dissertation as an independent event, not a collaborative experience requiring input from many people. I quickly learned that the process of attaining new learning required connecting with many acquaintances from my twenty-seven years in education, the very essence of the WFSG experience. I not only relied on my dissertation committee and committee chair but also acquired a dissertation coach at the very end of the journey to guide and aid me in finishing the marathon that I started.

**Final Implications**

This research study revealed the following: The teacher collaboration process guided, successfully, the teachers’ increased understanding of the Standards for Mathematical Practice in preparation for the implementation of the CCSSM throughout the six-week study. The
application of a case study model provided me with the opportunity to use multiple sources of data, which was qualitative in nature (Yin, 2009). The Whole-Faculty Study Group model was applied, successfully, as a framework to the research study. The charter school WFSG participants perceived that they were consistently focused on the Standards for Mathematical Practice. They perceived that they had enhanced their capacity to be collaborative and collegial by participating in the job-embedded professional development model, which provided as a content study the eight essential standards for math practice in order for the participants to be prepared to implement the CCSS in mathematics in the fall.

**Limitations and Final Suggestions for Further Research**

This study was limited in scope because the sessions occurred at the end of the school year, a hectic time of year with many demands on the executive director, teachers, and leadership team members. There were only four study group sessions focused on understanding the CCSS math practice standards, which meant participants did not have time to apply what they learned about the standards to planning for implementation in the 2013-14 school year. This restricted schedule also meant that participants were not able to experience one complete WFSG action research cycle, which limited their understanding of the WFSG design. Since I facilitated the participants’ engagement in the CCSSM modules, the members of the group were not able to rotate group leader responsibilities as is typical in the WFSG design. Another limitation was that the study had only a small purposeful sample of six participants and only three math teachers. This limitation makes it difficult to generalize the findings from this study to all of the school’s math teachers.

These limitations lead to suggestions for further research. The study could be expanded to include more teacher teams engaging with the CCSS math practice modules in the same
school or in several other schools, both charter and non-charter schools, to see if similar results of increased understanding of the value of collaboration and of the role of the Standards for Mathematical Practice are obtained. The number of study group sessions could be extended to allow the researcher to learn about how participants apply their increased understanding of the math practice standards to prepare for implementation of the standards.

A second area of possible research is with the Whole Faculty Study Groups system. There has been no research on whether there are significant differences in the implementation of the WFSG design in charter schools versus regular schools. There has been only limited research on whether the work of individual study groups leads to measurable changes in teacher practice and student learning. Since active, engaged leadership support and access to resources were seen as important factors for the success of the study group in this study, it would be important to examine the extent of these supportive conditions in other schools and their impact on the performance of teacher teams.

A third area for further research is in the implementation of CCSS practice and content standards. As Heck, Weiss, & Pasley (2011) indicate in their report, much research is needed into how teachers, schools, districts, and states learn about and implement the CCSS practice and content standards and assessments and the impact that these implementation efforts have on teacher practice, students’ mathematical proficiency and learning, and the roles of teachers and students in classrooms.

**Final Summary and Conclusion**

This qualitative single case study in a rural start-up charter school in North Louisiana explored the impact that professional learning from Whole-Faculty Study Group sessions had on teachers’ understanding of the most significant contributions of the Standards for Mathematical
Practice in preparation of the implementation of the Common Core State Standards in mathematics. The theoretical framework proposed that structured time for collaboration would enhance teachers’ understanding of the math practice standards. The literature indicated that collaborative job-embedded professional learning can lead to improvements in teachers’ knowledge and practice and to improvements in student learning. It also indicated that understanding and appreciation of the CCSS Standards for Mathematical Practice is key to the successful implementation of the CCSSM content standards. The subordinate research questions in this study focused on teachers’ understanding of the goals for collaboration in professional learning and the factors that enhance or inhibit collaboration, the role of the math practice standards in CCSSM, and the teacher’s role in implementing the math practice standards.

According to the six teachers and leadership team members who participated in this study, their collaborative professional learning in the study group sessions had a positive impact on both their understanding of the value of collaboration and their understanding of, and perceived importance for, the math practice standards. The themes that emerged from the analysis of their responses about collaboration indicated that the purpose of collaboration is to empower teachers and establish common goals and that successful collaboration requires structures in place and connected resources to support the team’s work. They said the role of the math practice standards is to develop mathematically proficient students and to deepen teachers’ mathematical knowledge and using the math practice standards changes the role of both teachers and students, with teachers assuming a more facilitative role after designing rigorous performance tasks and with students taking a more active role in their own learning and developing their proficiency in the both the content and practice standards.
Chapter five concludes this research study. The findings above were supported by the literature, with the caveat that the scope of the study precluded following teachers as they continued to work in collaborative teams to apply their deeper understanding of the math practice standards to the design of student performance tasks and to their work in classrooms with students. Recommendations to this charter school invite them to expand structured and purposeful teacher collaboration to all faculty, engage all math teachers in examining the CCSS math practice standards, orient all faculty to the key ideas and shifts in roles for teachers and students in both the CCSS math and ELA standards, and develop a schoolwide CCSS implementation plan that incorporates teacher collaboration teams. Recommendations to other schools invite school leadership teams to assess the effectiveness of current systems for job-embedded teacher collaboration and CCSSM training and implementation and developing action plans to align and improve both systems. Recommendations to education leaders and policy makers invite them to ensure that CCSS implementation leads to significant changes for roles of teachers and students and that educators at all levels have the time and support they need work together collaboratively to learn about and implement CCSS. Suggestions for further research include expanding this study on the impact of collaborative learning about the CCSS math practice standards to encompass more teacher teams over longer periods in the same or similar schools, engaging in more research on the impact of job-embedded teacher collaboration systems on teacher practice and student learning and the role of supportive leadership and appropriate resources, and initiating research into how teachers, schools, districts, and states learn about and implement the CCSSM practice and content standards and assessments and the impact that these implementation efforts have on teacher practice, students’ mathematical proficiency and learning, and the roles of teachers and students in classrooms.
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APPENDIX A: FOCUS GROUP INTERVIEW QUESTIONS

The overall guiding question of the research is: What impact has the professional learning from Whole-Faculty Study Group sessions had on teachers’ understanding the most significant contributions of the Standards for Mathematical Practice in preparation of the implementation of the Common Core State Standards in mathematics?

The subordinate research questions and associated focus group questions are:

1. What do teachers and administrators perceive as the goal(s) of collaboration in Whole-Faculty Study Groups (WFSG)?
   
   Focus Group Question: How do you utilize collaboration to achieve your vision?

2. What factors inhibit or promote collaboration in a WFSG?
   
   Focus Group Question: What systems, resources, and relationships support collaboration?

3. What is the role of the Standards for Mathematical Practice in the Common Core State Standards in Mathematics (CCSSM)?
   
   Focus Group Question: What might be the result if you focus on these Practices in isolation of the math content standards?

4. Why is it important for teachers to better understand the Standards for Mathematical Practice in the CCSSM?
   
   Focus Group Question: What is the primary role of the student in implementing the Math Practices?
APPENDIX B: INDIVIDUAL INTERVIEW QUESTIONS

The overall guiding question of the research is: What impact has the professional learning from Whole-Faculty Study Group sessions had on teachers’ understanding the most significant contributions of the Standards for Mathematical Practice in preparation of the implementation of the Common Core State Standards in mathematics?

The subordinate research questions and associated interview questions are:

1. What do teachers and administrators perceive as the goal(s) of collaboration in Whole-Faculty Study Groups (WFSG)?
   
   Interview Question: What is needed for successful collaboration?

2. What factors inhibit or promote collaboration in a WFSG?
   
   Interview Question: What expectations for meetings encourage collaboration?

3. What is the role of the Standards for Mathematical Practice in the Common Core State Standards in Mathematics (CCSSM)?
   
   Interview Question: How do these Practices relate to math content standards?

4. Why is it important for teachers to better understand the Standards for Mathematical Practice in the CCSSM?
   
   Interview Question: How is the role of teacher when implementing the Math Practices different than the expected role of the past?
APPENDIX C: PRE- AND POST-ASSESSMENT WRITTEN QUESTIONS

The overall guiding question of the research is: What impact has the professional learning from Whole-Faculty Study Group sessions had on teachers’ understanding the most significant contributions of the Standards for Mathematical Practice in preparation of the implementation of the Common Core State Standards in mathematics?

The subordinate research questions and associated pre- and post-assessment written questions are:

1. What do teachers and administrators perceive as the goal(s) of collaboration in Whole-Faculty Study Groups (WFSG)?
   No Pre- and Post-Assessment Written Questions.

2. What factors inhibit or promote collaboration in a WFSG?
   No Pre- and Post-Assessment Written Questions.

3. What is the role of the Standards for Mathematical Practice in the Common Core State Standards in Mathematics (CCSSM)?
   No Pre- and Post-Assessment Written Questions.

4. Why is it important for teachers to better understand the Standards for Mathematical Practice in the CCSSM?
   Pre/Post Written Question 1: How is the role of teacher when implementing the Math Practices different than the expected role of the past?
   Pre/Post Written Question 2: What is the primary role of the student in implementing the Math Practices?
APPENDIX D: IRB APPLICATION

Application for Exemption from Institutional Oversight

Unless qualified as meeting the specific criteria for exemption from institutional review Board (IRB) oversight, all LSU research projects using living humans as subjects, or samples, or data obtained from humans, directly or indirectly, with or without their consent, must be approved or exempted in advance by the LSU IRB. This Form helps the PI determine if a project may be exempted, and is used to request an exemption.

- Applicant, please fill out the application in its entirety and include the completed application as well as parts A-F, listed below, when submitting to the IRB. Once the application is completed, please submit two copies of the completed application to the IRB office or to a member of the Human Subjects Screening Committee. Members of this committee can be found at http://research.lsu.edu/CompliancePoliciesProcedures/InstitutionalReviewBoard%28IRB%29/item24737.html

- A complete application includes all of the following:
  (A) Two copies of this completed form and two copies of parts B thru F.
  (B) A brief project description (adequate to evaluate risks to subjects and to explain your responses to Parts 1 & 2)
  (C) Copies of all instruments to be used.
  *If this proposal is part of a grant proposal, include a copy of the proposal and all recruitment material.
  (D) The consent form that you will use in the study (see part 3 for more information.)
  (E) Certificate of Completion of Human Subjects Protection Training for all personnel involved in the project, including students who are involved with testing or handling data, unless already on file with the IRB. Training link: (http://training.php.nichiresearch.com/users/login.php)
  (F) IRB Security of Data Agreement: (http://research.lsu.edu/files/item207477.pdf)

1) Principal Investigator: Terri Roberts
   Dept: Education
   Ph: 318.680.9978
   E-mail: terriroberts@centurylink.net
   Rank: Doctoral Student

2) Co Investigator(s): Please include department, rank, phone and e-mail for each
   Dr. Margaret Mary Sulentic Dowell
   If student, please identify and name supervising professor in this space

3) Project Title: An Insider's View: An Investigation of Implementing the Common Core Standards for Mathematical Practice for Elementary Teachers in a Rural Louisiana Charter School

4) Proposal? (Yes or no) No
   If yes, LSU Proposal Number
   Also, if Yes, either
   ○ This application completely matches the scope of work in the grant
   OR
   More IRB Applications will be filed later

5) Subject pool (e.g. Psychology students)
   Elementary Teachers and Administrator
   *Circle any "vulnerable populations" to be used: children <18; the mentally impaired, pregnant women, the elderly, other Projects with incarcerated persons cannot be exempted.

6) PI Signature: Date 4/24/2013 (no per signatures)

**I certify my responses are accurate and complete. If the project scope or design is later changes, I will resubmit for review. I will obtain written approval from the Authorized Representative of all non-LSU institutions in which the study is conducted. I also understand that it is my responsibility to maintain copies of all consent forms at LSU for three years after completion of the study. If I leave LSU before that time the consent forms should be preserved in the Departmental Office.

Screening Committee Action: Exempted ☑ Not Exempted No Category/Paragraph_

Signed Consent Waived?: Yes / No

Reviewer Signature Date 4/30/13

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Research Study Interest Form

Dear Teacher,

There is very little research related to a professional learning collaborative structure in charter schools. I am currently working with your principal in a study that will provide a professional development on establishing Whole Faculty Study Groups and then within that scheduled time and space provide training modules for third-, fourth-, and fifth-grade teachers to deeply examine the Common Core Standards for Mathematical Practices. The purpose of the study is to explore whether teachers who participate will be prepared to transition to the Common Core State Standards in mathematics in the fall of the 2013-14 school year with full implementation of standards and assessments—Partnership for Assessment of Readiness for College and Careers (PARCC 2011)—the following 2014-15 school year. I am asking for your involvement in this project as well.

If you choose to be involved in this study you will be asked to participate in two approximately 30 minute interviews—one individual interview and one focus group interview. Both interviews will occur in May. I will come to the school to conduct the interviews. All information you provide will be strictly confidential. The questions I will ask will be related to the Whole Faculty Group collaboration structure and the Standards for Mathematical Practice. If you are willing to participate, please fill out the information below. Please return this form to your principal and I will collect on an upcoming school site visit.

I will contact you later to provide more details and set interview schedules.

Thank you for your help.

Teri Roberts

_____ Yes, I am willing to participate in this research.

Name: 

Grade level(s) that you teach math: 

Email address: 

Preferred contact Phone number: 

If you have any questions about subject rights or other concerns please contact:
Study Exempted By:
Dr. Robert C. Matthews, Chairman
Institutional Review Board
Louisiana State University
203 B-1 David Boyd Hall
225-578-8692 | www.lsu.edu/rb
Exemption Expires: 11/24/2016

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Appendix C

Informed Consent to Participate in Research

1. Study Title: An Insider’s View: An Investigation of Implementing The Common Core Standards for Mathematical Practice for Elementary Teachers in a Rural Louisiana Charter School

2. Performance Sites: One Charter School

3. Investigator: Teri Roberts is the sole and primary investigator. She can be contacted for questions regarding the study at (318) 680-9978.

4. Purpose of Study: The purpose of the proposed six week study is to examine one professional development implementation in the form of a professional learning collaborative structure—Whole Faculty Study Groups—and then within that scheduled time and space provide training modules for third-, fourth-, and fifth-grade teachers to deeply examine the CCSS Mathematical Practices.

5. Participant Inclusion: Charter School Principal and staff members in this charter school.

6. Number of Participants: 1 school administrator; 1 curriculum coordinator; 1 remedial teacher, 6 teachers

7. Study Procedures: Participants will complete two (2) approximately 30 minute interviews during the six-week study. The information will be combined with archival data about the school.

8. Benefits: Participation in the study may help strengthen the teacher collaboration structure as well as impart a set of knowledge and resources for math teachers.

9. Risk: Names will not be recorded to prevent any risk of tracking data to the participant. Data from interviews will be kept in a locked cabinet and accessed only by the researcher during the study. Data will be destroyed upon completion of the study.

10. Right to refuse: You may choose not to participate or withdraw from participation at any time with no penalty or loss of any benefits to which you might be otherwise entitled.

11. Privacy: Results from this study may be published, but no names or individual identifying information will be included in any publications. Participants’ identifying information and data will remain confidential unless disclosure is compelled by law.

12. Consent: If you have questions about subjects rights or other concerns please contact Dr. Robert C. Matthews, Institutional Review Board, and (225) 578-8692. Please keep a copy of this letter for your records if you choose to participate.

Signature ____________________________ Date __________________
THE VITA

Teri Roberts earned her Bachelor of Arts degree in Elementary Education from The University of Louisiana at Monroe in 1986. After teaching for six years in the Louisiana public school system, Ms. Roberts went on to earn her Master of Education degree in Elementary Education also from The University of Louisiana at Monroe in 1992; and followed with a Master’s Degree plus 30 graduate hours in Supervision and Administration. In the fall of 2009, she began her pursuit of the Doctor of Philosophy in Curriculum and Instruction at Louisiana State University, under the supervision of Dr. Margaret-Mary Sulentic Dowell.

Ms. Roberts is a dedicated educator of twenty-seven years who is highly knowledgeable in the elementary mathematics content standards and standards for mathematical practice associated with The Common Core State Standards. Standards-based lesson planning with formative assessments is her area of expertise. She is skilled in helping administrators and teachers grow professionally. Students are the focus of all of her well-planned lessons and professional learning presentations. Therefore, analyzing student work is her passion. She is an accomplished mentor in the Whole-Faculty Study Group Process. She has presented at the local, regional, state and national levels.