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The Impact Collaborative Data Analysis has on Student Achievement and Teacher Practice in High School Mathematics Classrooms in Suburban School Districts in the Mid-West Region of New York

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Abstract

This research study is an examination of ongoing collaborative data analysis among educators and the potential impact it has on instructional improvement as well as student achievement. Collaborative data-driven decision making has been identified in theory and research as a promising model for continuous school improvement yet districts, schools and teachers are hesitant to change traditional practices (DuFour, Eaker & DuFour, 2005; Gruenert, 2005; Steele & Boudett, 2008). The purpose of this study was to reveal how integrating formative and summative assessments, collecting and analyzing data, and collaborating as teams expands teacher understanding of data driven decision making and leads to improved teaching practices. A mixed methods research design was chosen for this study to better understand the research problem by triangulating numeric trends from quantitative data and the detail of qualitative data. A quasi-experimental approach was used to measure the relationship between collaborative data analysis and student achievement, as well as the progress a school is making with the implementation of data-driven instruction and assessment. At the same time, interviews were conducted to explore teacher's views on the implementation and effectiveness of collaborative data analysis with respect to their instructional practices and student learning. The findings suggest that when teachers are provided structured time within the school day, meaningful collaborative data analysis that leads to instructional adjustments and targeted student interventions can occur. The need for additional research studies vii that investigate grade level or content area collaborative inquiry teams impact on student performance based on both formative and summative assessments was identified.

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Dedication

The dissertation process is a remarkable experience which I could not have accomplished without the encouragement and guidance of many individuals. This work is dedicated to my father, Patrick Gillette, a man of infinite wisdom and unwavering commitment to his family. The completion of this dissertation was made possible due to his love and support. I am incredibly grateful for all of the educational opportunities he has afforded me, especially my pursuit of a doctoral degree. A special note of appreciation goes to my husband, Mark, for his love, understanding and reassurance, as well as proof reading this document, every step of the way. I must also thank my children, Kylie and Sean, for their love, encouragement and patience throughout the entire process. I am forever indebted to my family for their never-ending support of my education and professional career.

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Biographical Sketch

Michelle M. Ryan has been the Director of Monroe/Orleans Accountability, Assessment and Reporting Services (MAARS) for Monroe #1 and Monroe 2-Orleans Board of Cooperative Services (BOCES) since January 2010. She is a graduate of the State University of New York (SUNY) at Geneseo where she received her Bachelor of Arts degree in Mathematics in 1988 as well as her Master of Science degree in Secondary Mathematics Education in 1994. Michelle went on to complete her Certificate of Advanced Study in Educational Administration at SUNY Oswego in 2001. She has spent the majority of her career in education working for the West Irondequoit Central School District. Michelle taught 7th and 8th grade mathematics at Dake Junior High School for 10 years. She then moved into district administration, first as the K-6 Mathematics and Science Curriculum Supervisor for one year, then as the Principal of Southlawn (K-3) and Rogers (4-6) Schools for 8 years. In her current position, Michelle has the pleasure of interacting with various members of the Monroe #1 and Monroe 2-Orleans BOCES component school districts as well as with representatives from the New York State Education Department on matters that pertain to data warehousing, New York State reporting, testing and accountability. Upon encouragement from her family, Michelle began her doctoral studies in the Ed.D. Program in Executive Leadership at St. John Fisher College in the summer of 2012.

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Abstract

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Chapter 1: Introduction

Introduction

The standards and accountability movement in education has put school districts under a tremendous amount of pressure to produce measurable results. Federal, state, and district leaders are increasingly emphasizing data-driven decision making as a way to improve teaching and learning. Teacher and principal evaluations expect these educators to use multiple sources of data to make informed decisions. In 2009, President Barack Obama presented states with an opportunity to compete in a "Race to the Top" (RTTT) initiative designed to encourage systemic reform and innovative approaches to teaching and learning. To qualify for RTTT funding, states were required to advance reforms around four specific areas referred to as the Four Assurances: (a) adopting internationally-benchmarked standards and assessments; (b) recruiting, developing, retaining, and rewarding effective teachers and principals; (c) building instructional data systems that measure student success and inform teachers and principals how they can improve their practices; and (d) turning around the lowest-performing schools (New York State Education Department, 2010). On August 24, 2010 the U.S. Department of Education announced that New York State had been awarded $696,646,000 as a winner in the second round of the federal Race to the Top competition. NYS is using the RTTT funding to support the Regents' reform agenda. The NYS Regents Reform Agenda is comprised of three interrelated initiatives: common core learning standards and assessments, data-driven instruction, and teacher and leader effectiveness. The Common

Core State Standards for English language arts and mathematics define the knowledge and skills students should learn during their K-12 educational experiences. The standards are intended to provide consistency across districts and states so that all children are taught rigorous content and prepared for college or employment when they graduate. The New York State Common Core Learning Standards for English Language Arts & Literacy in History, Science and Technical subjects, as well as for Mathematics were adopted by the New York State Board of Regents in January 2011(NYSED, 2011). As teachers implement the Common Core Learning Standards, they are expected to use formative assessments to evaluate student learning along the way. Formative assessment results provide educators with the ability to diagnose student learning with enough time to make instructional modifications as well as provide feedback to students (Ainsworth, 2007). Ideally, utilizing the data gathered from classroom assessments, teachers can adjust and enrich future instruction to optimize student success. Effective data-driven instruction requires quality assessments, analysis, action and most importantly, a collaborative culture (Bambrick-Santoyo, 2010). The third component of the Regents' reform agenda is a comprehensive teacher and principal evaluation system based on multiple measures of effectiveness, including student achievement. The breakdown of the evaluation is as follows: 20% student growth on state assessments or comparable measure, 20% student achievement on a local measure, and 60% based on performance in relation to teacher/leadership standards. NYS Education Law §3012-c now requires that both teachers and principals annual professional performance reviews (APPRs) result in a single effectiveness score (NYSED, 2012a). These scores fall into one of four rating categories: Highly Effective, Effective, Developing, and Ineffective. Accountability is no

longer just at the institutional level, but at the individual level as well. Teachers need support and professional development that will equip them with knowledge and skills that will aid them in using student achievement data to improve instruction, especially now that student growth is part of the teacher evaluation process. Job embedded learning in which teachers work together to address challenges that are relevant to them is the new vision of professional development (Dufour et al., 2005). In these times of high stakes accountability, all educators must learn how to collect, analyze, and use data to improve instructional practice and student learning. If schools are not proactively raising the achievement for all students and preparing them for the demands of the 21st century, they will fall short of what our society requires of them (Boykin & Noguera, 2011). Effective data-driven instruction, when centered on student learning, has the potential to close the achievement gap.

Improving achievement for all students has been the focus of educational reform for decades. In 1983, the National Commission on Excellence in Education released the report *A Nation at Risk* (U.S. Department of Education, 1983). This study was in response to public concern that the United States educational system was failing, in comparison to other countries, to prepare our students to compete in the world. The report led to a focus on accountability, the standards movement as well as comprehensive reform efforts. In 2008 the National Commission on Excellence in Education released a follow-up report titled *A Nation Accountable: Twenty Five Years after a Nation at Risk* (U.S. Department of Education, 2008). This report declared that our education system is not keeping pace with the increasing demands of our global economy which has put our nation at even more risk than we were in 1983. The report stated that of 20 children born

in 1983, six did not graduate from high school on time in 2001 and of the 14 who did, 10 started college that fall, but only five earned a bachelor's degree by the spring of 2007. Due to the standards and accountability movement, as well as the enactment of the No Child Left Behind Act (NCLB) in 2001, we have data to evaluate student performance and report the results. NCLB revived national attention on the achievement gap by mandating that states set the same performance targets for children from economically disadvantaged families; students with disabilities; English language learners; and children from all ethnic and racial groups (Fisher, Frey, & Lapp, 2011). Yet despite national efforts to close the achievement gap, huge disparities still exist among the NCLB subgroups. Trends in the National Assessment of Education Progress (NAEP) show that American education outcomes have remained relatively unchanged. The NAEP long-term trend assessments have made it possible to chart educational progress since the early 1970s. Although the long-term trend assessments date back to the1970s, the original assessment format, content, and procedures were revised in 2004. The long-term trend assessments given in the 2007–08 school year to students at ages 9, 13, and 17 indicate that the reading and mathematics score gaps between White and Black students at all three ages showed no significant change from 2004 to 2008. There was also no significant change in the score gaps between White and Hispanic students (Rampey, Dion, & Donahue, 2009). It is essential that educators have a clear understanding of the causes of the gap and not adopt "quick-fix" solutions (Boykin & Noguera, 2011).

Although there continues to be disparity in academic outcomes that correspond to race and socioeconomic status of students, research shows that several schools have made measurable progress in closing the achievement gap. One example is Reeves' (2000)

research with "90/90/90" schools (at least 90% of students qualified for free and reduced lunches, were members of ethnic minority groups, and met the district or state mandated standards in reading or another subject). Reeves (2000) found common assessments, constructive data analysis, the impact of collaboration, as well as the value of feedback to be characteristics that were similar across the schools with the greatest academic improvement. In 2006-07, Marylin Avenue Elementary School in Livermore, California had 76% of students receiving free/reduced lunch and the percent of Hispanic students increased to 66% (Bernhardt, 2009). That same year the leadership team at Marylin Avenue began to focus on data-driven decision making. They established collaborative teams with consistent meeting times, created common assessments and examined student data. The staff observed how their current population had changed and realized the strategies and services they were using needed to be adjusted as well. Student achievement at Marylin Avenue improved at every grade level, in every subject area, and with every student group two years in a row (Bernhardt, 2009). Both Reeves and Bernhardt's research suggests that collaborative data analysis and effective classroom practices can make the difference for all students.

Problem Statement

For standards and accountability policies to improve teaching and learning, schools must use data to make decisions about whether their students are meeting the standards, if not, then use data to change practices and monitor the effectiveness of those adjustments (Ingram, Louis & Schroeder, 2004). Technological advances have made collecting and disseminating data easier. As a result, teachers are daunted by the amount of assessment data available to them. The problem is that many educators lack the

training or experience in using data to make decisions and thus feel overwhelmed by the prospect. Teachers are "data rich, but information poor;" in other words having data available does not mean that the data is being used effectively to guide instructional improvements (Ronka, Lachat, Slaughter, & Meitzer, 2008). Administrators and teachers are not using data adequately to identify areas of improvement in teaching, learning, and monitoring student progress. Insisting that educators use data without building processes for their use can be counterproductive (Hess & Mehta, 2013). The analysis of data could become just another compliance exercise which can create resentment among educators. Teachers have been given little preparation for productive organization and analysis of data (Wayman & Stringfield, 2006). School districts need to proactively foster the use of data to guide educational decision making and practice. Educators are more likely to believe in the value of data if they have the skills to use them and witness positive results in student performance. Organizing the work of instructional improvement around a process consisting of specific, manageable steps helps educators build confidence and skill in data analysis (Boudett, City, & Murnane, 2005). Looking at data should be seen as a process not an event. Sindelar (2003) suggested that consistent analysis of assessment data allows teachers to improve practice, which, in turn, improves student achievement. According to Sindelar, if educators want to use data effectively they must first ask three crucial questions: (a) what do we want students to learn, (b) how will we know if students have learned it, and (c) how will we respond if students haven't learned what they need to know? The first question is answered by state standards and district curriculum. The consistent use of formative assessment will address the second question and the data from the assessments will help determine how to increase student

performance, which is the third question. Sindelar (2003) proposes using the data to change curriculum, refocus instruction and/or address individual student weaknesses and build upon student strengths.

Strong evidence exists regarding the benefits of looking at student work, but further investigation is required as far as how teachers can learn to productively work together to monitor and achieve intended outcomes. When educators are involved in analyzing and interpreting data collaboratively, they become more invested in the school improvement efforts (Boudett et al., 2005). Yet, collecting and using data systematically does not occur naturally when teachers work together. Collegial conversations must not be confused with focused professional dialogue which is essential to school improvement (Schmoker, 2004a). Teachers need professional development on collaboration skills and how to have effective data-driven dialogue. Specific training in gathering data, making sense of the information and figuring out the instructional implications is essential (David, 2008). Inquiry teams must develop and utilize protocols to build the capacity and trust required for meaningful collaborative work. Teachers need to feel comfortable asking challenging, constructive questions of each other. Strong leadership and shared norms are fundamental to this type of collaborative culture. Establishing group norms promotes respect and creates an atmosphere conducive to discussions about data. Levine and Marcus (2007) studied teacher collaboration in two high schools. The teachers in this study learned to use productive practices, such as critiquing colleagues' instruction and pushing each other on difficult issues around meeting the diverse needs of their traditionally underserved students. From this study, it was noted that when educators

have the time, training and structures for identifying the areas of challenge it opens up lines of communication and creates a community of learners.

The research on Professional Learning Communities (PLCs) supports the value of collaborative inquiry. Organizing, analyzing, and interpreting data is the foundation of a PLC. If collaborative data analysis is to become more than the latest trend in educational reform, school leaders will need to help teams realize the potential for transformative learning and impact on students (Nelson, Slavit, & Deuel, 2012). The best staff development occurs daily in the school rather than at a one day workshop. Teachers learn best from their colleagues, in settings where they teach each other the art of teaching (Schmoker, 2004c). Since time is frequently a concern of teachers it is essential that the meetings are productive and not spent on administrative tasks. Continuous improvement is a key factor in the reform movement. Students would be better served if educators embraced learning rather than teaching as the mission of their school (Dufour et al., 2005).

In summary, the problem investigated in this study is that teachers cannot accurately identify students' strengths and weaknesses, and develop next steps for instruction without using student achievement data effectively. However, knowledge of how to analyze and interpret data is not sufficient. The goal is to improve both teaching and learning by developing a culture where educators value collaborative inquiry and use data continuously.

Theoretical Rationale

The collaborative inquiry and/or professional learning communities model necessitates the setting and working relationships aligned with a social theory of learning

referred to as "communities of practice." Etienne Wenger (2011) defines a community of practice as a group of people who share a concern or passion for something they do and learn how to do it better as they interact regularly. The key to this theory is that learning involves active engagement in social communities. Wenger (2000) explains that there are three dimensions that are crucial to a community of practice:

1. Joint enterprise: a shared domain of interest where participants value their collective competence and learn from each other. Members recognize and address gaps in their knowledge and remain open to new ideas.
2. Mutual engagement: members build relationships, establish norms, and engage in joint activities and discussions. Participants trust each other and know how to interact productively.
3. Shared repertoire: members are competent practitioners who develop communal resources such as language, routines, artifacts, tools, etc. Participants are reflective on their repertoire, reconsider assumptions, uncover hidden possibilities, and use this self-awareness to move forward.

Communities of practice grow out of a joint interaction of competence and experience that involves mutual engagement (Wenger, 2000). Members of the community are united by what they accomplish together. Whether these communities come about spontaneously or through purposeful planning, their development depends on internal leadership. A community of practice is structured to promote shared leadership and build capacity of the participants, which in turn leads to systemic and sustainable change.

People and organizations in a variety of professions utilize communities of practice to improve their performance. Practical applications of the concept can be seen in business, government, education as well as the social sector. Communities of practice can drive strategy, solve problems, spread best practices and develop people's professional skills (Wenger & Snyder, 2000). A communities of practice framework has been used to describe the collaborative efforts of educators when they come together to review instruction, talk about outcomes, and reflect on their teaching. For example, teachers in a school district in the greater Vancouver area were asked to participate in a learning community with the common goal of co-constructing and evaluating instructional approaches. The professional development model that was used in this study was a "communities of practice" framework. The researchers' goals were to assist teachers in identifying principles underlying best practices, enacting principles in context, critically reflecting on outcomes, and constructing knowledge about teaching and learning based on new experiences (Butler, Lauscher, Jarvis-Selinger, & Beckingham, 2004). This two year project proved to be successful in that teachers profited from opportunities to share ideas with colleagues and collectively solve problems. Butler et al. (2004) were able to describe how using a community of practice professional development model promoted "deep rooted" changes in teaching and that conceptual knowledge can be reshaped within a collaborative learning community.

Dufour et al. (2005) contend that the most promising strategy to improve student learning is to develop teachers' capacity to function as a professional learning community (PLC). In a PLC, educators work together to make data-driven decisions. Schmoker (2004a) defines a PLC as a group of teachers who meet regularly as a team to identify

essential and valued student learning, develop common assessments, analyze current levels of student achievement, set goals, share strategies, and create lessons to improve learning. Job embedded learning where teachers work together to address challenges that are relevant to them is targeted professional development. Creating a collaborative culture has been described as the single most important factor for successful school reform (DuFour & Eaker, 1998). Both teachers and students benefit when a school shifts from a culture of isolation to a culture of collaboration. Staff development activities undertaken in isolation from teachers' ongoing classroom responsibilities rarely have much impact on teaching practice or on student learning (Guskey & Sparks, 1996).

Schools with a collaborative culture, focused on data driven decision making, have the potential for growth in both teacher and student learning. Effective schools have a community of adults committed to working together to develop the skills and knowledge of all students (Boudett et al., 2008). Data-driven decision making is not about analyzing test results just to identify students who with improved test taking skills can get a few more points to be proficient. Analyzing student data is about ensuring that all students have the required knowledge and skills to be successful in college as well as employment. Unfortunately, many educators lack the expertise on how to transform student achievement data into an action plan that will improve instruction and increase student learning (Boudett et al., 2008).

Teachers at an elementary school in Boston learned the value of using data to drive instructional change. After reviewing results on the state assessment, the staff was surprised to see that students performed poorly with written responses to literature. At this school, teachers frequently had the students write reading response letters for the

independent books they had read. When teachers brought the student work to a staff meeting, they realized that the students were primarily writing summaries. In addition to being surprised by the type of student writing they were seeing, the teachers also realized that they did not agree among themselves about the traits of a strong-reading response. As an outcome of this collaborative analysis, the teachers created a rubric for evaluating student responses at each grade level. Had the teachers not taken the time to examine classroom data collaboratively, they probably would not have found a shared instructional solution (Steele & Boudett, 2008). This case study illustrated the importance of analyzing student work, as well as the value of reviewing data collaboratively. This elementary school was one of eight schools that participated in a study using the Data Wise Improvement Process (see Figure 1.1), an approach to schoolwide instructional improvement developed by a team of educators in the Boston Public Schools and researchers at the Harvard Graduate School of Education (Boudett et al., 2005). A collaborative approach to data use for school improvement was a theme that went across all eight schools. To build a collaborative culture where teachers trust one another and promote instructional improvement, the process used to collect, analyze, and interpret data needs to emphasize solving problems, not passing judgment (Steele & Boudett, 2008). Having a specific process for using data helps teachers to gain confidence in their analysis skills.

Figure 1.1. Data Wise Improvement Process. Adapted from *Datawise* by K.P. Boudett, E.A. City and R.J. Murnane, 2005. Copyright 2005 by Harvard Education Press.

Love (2004) has a similar procedure for looking at student data that has five segments to it that she refers to as the Using Data Process (Figure 1.2). The aim of the Using Data Process is to influence school culture to be one in which educators use data continuously, collaboratively, and effectively to improve teaching and learning. In this process, teams of educators use data to develop their understanding of student learning problems and test out solutions together through rigorous constructive dialogue. When identifying a student learning problem the teams analyze multiple levels of student data in order to draw sound inferences and not make assumptions. To avoid quick fixes like teaching to the test, a step in this process is to verify causes in order to get to the root of

the problem. Through the use of this process teachers from four high schools in Orange County, California discovered that subgroups performing poorly in mathematics were often those students placed in low-level mathematics courses. The schools used this information to expand and offer more rigorous mathematics instruction to additional students (Love, 2004). Once the student learning problem is identified and root causes are determined teams are able to set specific, measurable goals and develop an action plan. Unlike action plans generated from the top down, teachers involved in this process are invested in the solutions they developed from their own collaborative inquiry (Love, 2004). Both the Data Wise Improvement Process and the Using Data Process are conceptual frameworks that outline possible courses of action based on the characteristics of effective data use grounded in the literature to help educators enhance their knowledge of using data efficiently and successfully.

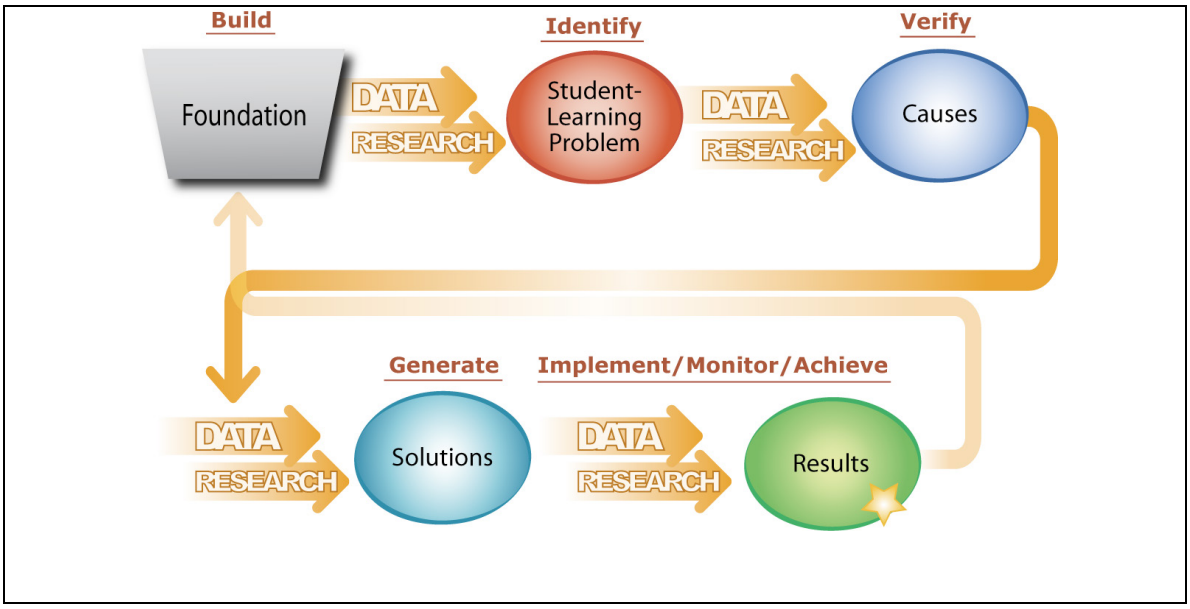

Figure 1.2. Using Data Process Adapted from The Data Coach's Guide to Improving Learning for all Students. N. Love, K. Stiles, S. Mundry, & K. DiRanna. Copyright 2008 by Corwin Press, p. 21.

The community of practice framework suggests that organizations should manage themselves as social learning systems. The theory implies that grouping people in this manner will not only maximize their collective knowledge and skills, but also facilitate new learning because adult learning is as much of a group activity as it is an individual act (Supovitz, 2002). A learner must process ideas individually as well as make them more relevant by sharing personal insights with others. The value of these systems is collegiality, reciprocity, expertise, contributions to the practice, and professional development. In order to implement communities of practice effectively, organizations must prioritize the structures, processes, and resources for this model of professional development and continuous improvement.

Statement of Purpose

The current educational climate mandates the use of data to make decisions about teaching and learning. Collaborative data-driven decision making has been identified in theory and research as a promising model for continuous school improvement yet districts, schools and teachers are hesitant to change traditional practices (DuFour et al., 2005; Gruenert, 2005; Steele & Boudett, 2008). The purpose of this study was to examine the impact ongoing collaborative data analysis has on instructional improvement and student achievement. By revealing more about how integrating formative and summative assessments, collecting and analyzing data, and collaborating as teams works, new insights have been gained which expand the understanding of data driven decision making and how it has lead to improved teaching practices.

Research Questions

This study intended to address the following research questions pertaining to collaborative data analysis by educators:

1. How does teacher participation in collaborative data analysis translate into improved instructional practices in the classroom?
2. How does teacher participation in collaborative data analysis improve student performance on state and local assessments?

Significance of the Study

The focus on educational reform in the United States has been instrumental in identifying areas in need of improvement. Many positive changes have occurred such as the standards movement. But the fact still remains that our students are being outperformed by children in other countries. Of the 70 countries tested by the Program for International Student Assessment (PISA), the United States fell in the middle. The children in America's schools are competing for highly-skilled jobs against peers in Finland and Singapore, where students are better-prepared (Levine, 2012). The achievement gap can be witnessed as early as kindergarten up through high school, as well as at the post-secondary level. Students' need for remedial courses in college is a key factor in the New York State Regents' reform agenda which is intended to prepare all students to be "college and career ready" (NYSED, 2012c). The 2012 New York State graduation rate was 74% with only 35% of the students being at the college and career ready standard (NYSED, 2012c). To be college and career ready in New York State, students must achieve at least a 75% on the ELA exam and at least an 80% on one of the mathematics exams. Although the suburban school districts in the Mid-West Region of

New York State have an average graduation rate of 90%, a substantial number of those students are not considered college and career ready. Only 74% of the students in these 20 districts achieved the ELA college and career standard and a significantly lower percentage, 58%, achieved it in mathematics. Identifying factors that will help schools meet these higher standards as well as the needs of their most diverse learners is critical (NYSED, 2012b).

In this era of accountability, data-driven decision making has emerged as a prominent school improvement strategy, but based on the research there is still work to be done before schools are routinely using data to effectively inform instruction. Most educators have had very little preparation for productive analysis of data. The challenges stem from common and traditional school structures and teacher interactions. Traditional school cultures where critical conversations about teaching and learning are not the norm. Even though the concept of professional learning communities has been around for over a decade, PLCs are still extremely rare. It is a rare school that has established regular meeting times for teachers to create assessments and refine their lessons and strategies together. These processes need to be standardized across schools within a district in order for collaborative teams to be effective. The impact of broader organizational contexts and institutional pressures impact the work of a teacher group (Nelson & Slavit, 2012). School districts need to proactively foster the use of data to guide educational decision making and practice. The data derived from regular classroom assessment can aide in shaping lesson plans as well as highlighting the educational needs of each student. More research is needed on different strategies to build teachers' capacity to analyze student achievement data for information on student understanding. If educators do not

effectively use data to make informed decisions with respect to school improvement, chances are the schools will not reach their goals to improve instruction and raise student achievement (Heritage & Chen, 2005).

Definitions of Terms

Aggregated data*:* Student-learning data results compiled at the largest level (Love, Stiles, Mundry, & DiRanna, (2008).

Collaboration: A systematic process in which teachers work together to analyze and improve classroom practice. Teachers work in teams, engaging in an ongoing cycle of questions that promote deep team learning (DuFour, 2004b).

Common assessments: assessments typically created collaboratively and used formatively by a team of teachers responsible for the same grade level or course (Dufour et al., 2005).

Data-driven instruction: The process of using data to inform decisions to improve teaching and learning (Bernhardt, 2009).

Disaggregated data: Student-learning data results separated into groups of data sets by race/ethnicity, language, economic level, and/or educational status (Love et al., 2008).

Feedback: Information about how we are doing in our efforts to reach a goal (Wiggins, 2012)

Formative assessment: assessment *for* learning used by teachers and students to advance, and not merely monitor, each student's learning (Stiggins, 2002).

Professional development: A comprehensive, sustained, and intensive approach to improving teachers' and principals' effectiveness in raising student achievement (Killion & Roy, 2009)

Professional learning community: *(PLC):* A group of teachers who meet regularly as a team to identify essential and valued student learning, develop common assessments, analyze current levels of student achievement, set goals, share strategies, and create lessons to improve learning (Schmoker, 2004a).

Summative assessment: assessment *of* learning used by teachers after the learning is complete, and is used to give a grade (Stiggins, 2002).

Triangulation: Analyzing other data to illuminate, confirm, or dispute what you learned through your initial analysis (Boudett et al., 2008).

Chapter Summary

Chapter 1 reviewed the problem, purpose, research questions, and significance of a study seeking to understand the impact collaborative data analysis has on teacher practice as well as student learning. Chapter 2 provides a review of the current scholarly literature and studies on data driven decision making, collaborative inquiry, professional learning communities, professional development, and the use of formative assessment. Chapters 3, 4, and 5 describe the research design methodology used to conduct the study, the results, and an interpretation of the findings respectively.

Chapter 2: Review of the Literature

Introduction and Purpose

Accountability policies such as the federal No Child Left Behind act require districts to use data to measure student progress toward standards and hold them accountable for improving student achievement (Ikemoto & Marsh, 2007). Due to reform efforts and accountability, school districts are increasingly focused on data-driven decision making as a means for improving both teaching and learning. Data-driven decision making in education refers to teachers and administrators systematically collecting and analyzing data to guide a range of decisions to help improve the success of students and schools (Ikemoto & Marsh, 2007). The mission of all school districts is not to ensure that students are taught, but rather, that they learn. Policy makers at all levels have articulated the expectations that educators use data to drive instructional improvements and track student progress (Marsh, 2012). Teachers and administrators have access to large volumes of data, but that does not necessarily translate to data being used effectively for continuous school improvement. Teachers have been provided very little preparation for productive organization and analysis of data (Wayman & Stringfield, 2006). The research indicates that there are several factors that can positively influence teachers' capacity for data use. This review of the literature looks at the following themes: transforming instructional practice through professional learning communities, moving beyond collegial conversations with collaborative inquiry, cultivating effective data-driven decision making, and using assessment for student and teacher learning.

Transforming Instructional Practice through Professional Learning Communities

Professional learning communities are job embedded staff development opportunities where teachers can hone their craft by learning from colleagues. Professional development provided to teachers is only successful if the emphasized instructional practices are adopted. Research has shown that teachers' espoused instructional practices do not always match their enacted practices (Polly & Hannafin, 2011). Teachers tend to only implement pedagogies that align with their beliefs. To increase the likelihood of implementation, teachers must have confidence that their participation will improve their classroom practices and produce better results for students. Polly and Hannafin (2011) examined the extent to which teachers enacted the practices learned from a learner-centered professional development (LCPD) during their mathematics instruction. This professional development focused on the goal of supporting teachers' implementation of learner-centered mathematical instructional practices such as: rich mathematical tasks, fostering students' mathematical communication, multiple representations of mathematical concepts, integrating technology in meaningful ways and posing high-level questions. Several interviews (baseline, post-observation, and end of study) were conducted to gather information on teachers' espoused practices. Enacted practices were analyzed multiple times using video of classroom lessons. The analysis of the teachers' enacted practices indicated very little alignment between the teachers observed practices and those emphasized during workshops. Teachers implemented only a few of the strategies taught during the professional development. The only tasks that demonstrated learner-centered pedagogies were ones adopted directly from the professional development or co-planned with the

professional developer. The findings from this study suggest implementation of new pedagogy is improved with ongoing support and collaboration. Professional development should involve opportunities for teachers to engage as learners, build pedagogical and disciplinary knowledge as well as co-construct new visions of practice in context (Nelson & Slavit, 2008). The type of professional development teachers receive has been shifting from one day workshops to a more job embedded, reflective and collaborative structure. The shortness of most staff development programs is the opposite of what is needed to promote continuous improvement and embed change within a school's culture (DuFour, 2004a). Effective professional development not only helps teachers to acquire new knowledge, but also pushes teachers to adjust their instruction in ways that benefit students.

The key is to replace a belief in experts who deliver knowledge of good teaching in workshops with communities of teachers who learn through ongoing collaboration and practice (Schmoker, 2004c). Small communities make it easier to establish a collaborative culture where teachers feel comfortable sharing instructional practices. Multiple terms, including "teacher study groups," "inquiry teams," "communities of practice," and "professional learning communities" are being used to describe the concept of community as a means toward teacher professional development and education reform (Chou, 2011). The term "professional learning communities" has been used in so many different contexts that perhaps it is losing the true meaning of the fundamental concept. Simply creating a community will not change instructional practice significantly. As Schmoker (2004b) stated, "We can't just arrange for teachers to meet and then assume that close scrutiny and productive adjustment of teaching practices will automatically

ensue" (p.85). Teaching teams need structure and protocols in order to effectively work together. Lack of direction and consistency was apparent in Lippy & Zamora's (2012) study where they examined the implementation of PLCs in 12 middle schools in a large urban school district. Each school was expected to establish PLCs, but was given minimal direction on how to go about it. As a result, the PLCs functioned differently across the middle schools. A quantitative survey method was used to gather data on the participants' perception of the implementation of PLCs in their schools. The sample population of 196 academic teachers was controlled by the following selection criteria: faculty members were from one of the twelve schools and had certification in English, mathematics, social studies or science. The Professional Learning Community Assessment – Revised (created by Olivier, Hipp, and Huffman) was the survey instrument used and had a response rate of 57% (Lippy & Zamora, 2012). The results indicated that the two domains with the greatest level of implementation across the PLCs were shared values and vision, and supportive relationships. A shared vision and positive relationships are essential components to building the trusting environment required for collaborative work. The two domains that demonstrated the least amount of integration into the schools were shared personal practice and supportive structures. Shared personal practice is a fundamental component of PLCs that are effective at improving instruction (DuFour et al., 2005; Lippy & Zamora, 2012). This study indicated a need to standardize school practices to assure consistent implementation of professional learning communities. District and school leaders must provide teachers with the necessary time, structures, strategies, and support to help them hone their instructional craft knowledge (Chou, 2011). Professional learning communities can make a significant impact on

school improvement when they are embedded in a school culture. The core principles of a professional learning community (PLC) are these: ensuring that students learn, promoting a culture of collaboration, and having a focus on results (DuFour, 2004b; Eaker & Keating, 2008). A collaborative culture only benefits student achievement if educators focus their efforts on factors that are within their control and are directly related to classroom practices and student learning.

In another study on the implementation of Professional Learning Communities, Graham (2007) conducted a mixed method case study on the relationship between professional learning community experiences and teacher improvement in a new middle school. The core academic teachers (i.e., English language arts, mathematics, science, and social studies) from sixth, seventh and eighth grade were organized into same-grade, same subject PLCs, which represented a departure from the traditional interdisciplinary teams at the middle school level. The Teacher Activity Survey (Garet et al., 1999) was sent to all 20 core academic teachers with a response rate of 75%. This study found that a strong positive relationship existed between professional learning activities and teacher improvement, but the relationship was contingent on multiple factors. Organizationally, the teachers equated the success of the PLCs with foundational factors such as: block schedule, common planning time, and strong leadership. Although those features help to create an environment in which PLC activities could take place they were not enough for teacher improvement to occur. The disparity in the eighth grade survey results with the sixth and seventh grade result suggested other aspects had more impact on teacher improvement. Teachers in all three grade levels reported meeting in teams to discuss administrative issues, but only the sixth and seventh grade teachers mentioned

collaborative dialogue that was focused on curricular and instructional issues. As a result, the sixth and seventh grade teachers felt the PLC activities had a positive impact on their professional development. Teacher improvement within a PLC is ultimately based on the teachers' ability to build a strong sense of trust and team community. Honest, specific, and descriptive feedback from peers can be invaluable to teachers. In order to see the kind of change necessary to improve student learning, teams of educators need to establish trusting relationships that allow them to go beneath the surface matters typically discussed among teachers and engage in deeper conversations about instruction and student achievement (Cranston, 2011). Collegial relationships allow teachers to share expertise and provide opportunities for collective learning.

In a study conducted by Bezzina (2006) on the transition to professional learning communities in secondary schools, he also found that collegial relations and collective learning are at the core of building capacity for school improvement. Developing relationships seems to require time, practice, and support. Strong relationships are essential to counter teacher isolation and to improve curriculum and instruction (Bezzina, 2006). A major challenge in many schools will be to break the norm of teaching in isolation. PLCs offer opportunities to collaboratively plan lessons and assessments. Once the benefits of helpful feedback and support in a PLC are realized, teachers will likely seek more peer interactions of this nature. At the heart of the PLC model is the idea of teams of teachers meeting together and engaging in ongoing, substantive conversations about issues related to teaching and learning (Graham, 2007).

Based on the research reviewed above, teachers are discovering that learning from each other is more professionally rewarding and effective than their previous experiences

in more traditional professional development settings. Collaborative models of professional development emphasize the importance of nurturing learning communities where teachers try new ideas, reflect on outcomes, and co-construct knowledge about teaching and learning in the context of authentic activity (Butler et al., 2004). Learning communities provide a safe environment for teachers to learn and build knowledge together. Collaborative models of professional development engage teachers in joint inquiry about teaching and learning as a means of shifting practice (Butler et al., 2004).

Moving Beyond Collegial Conversations with Collaborative Inquiry

Teachers are likely to engage in reflective inquiry about instruction and actually enact the practices learned when professional development occurs in a collaborative professional learning community (Hathorn, Nelson, Perkins, & Slavit, 2008; Polly & Hannafin, 2011; Snow-Gerono, 2005). The process of inquiry is a powerful way for teachers to reflect on and improve instruction. Professional development models of training educators in collaborative inquiry include a major emphasis on the cyclical nature of inquiry, structured approaches to data-driven dialogue, and focus on using educators' own data and school challenges rather than hypothetical cases (Kerr, Marsh, Ikemoto, Darilek, & Barney, 2006). Learning protocols and skills for analyzing data using actual student work brings relevance to the staff development. When educators are involved in analyzing and interpreting data collaboratively, they tend to become more invested in the school improvement efforts (Boudett et al., 2005). However, collecting and using data systematically does not occur naturally when teachers work together. Collegial conversations should not be confused with focused professional dialogue which is essential to school improvement (Schmoker, 2004a). Research indicates the need for

teacher professional development on collaboration skills, inquiry, and how to have effective data-driven dialogue. Hathorn et al. (2008) sought to better understand how professional developers could support secondary math and science teachers' engagement in collaborative inquiry. A group of 12 staff developers known as the "steering committee" came together to design a professional development program as part of the Partnership for Reform in Secondary Science and Mathematics (PRiSSM) project. Teachers from 22 middle and high schools were organized into professional learning communities which were utilized as the vehicle to support collaborative inquiry. Through the triangulation of qualitative data sources, this study found that the quality of professional development was enhanced by the team member's ability to take an inquiry stance. An inquiry stance is the willingness to wonder, reflect, ask questions, and seek to understand by collaborating with one another. The use of collaborative inquiry assisted with the formation of relationships among group members, as well as the sharing of knowledge.

Snow-Gerono (2005) also looked at the benefits of professional learning communities as means for professional development for teachers' with an inquiry stance. Inquiry in this study was defined as systematic, intentional research by teachers. This phenomenological case study explored the perceptions of six veteran elementary teachers and their ideas about what is necessary for a culture of inquiry to thrive. All of the teachers worked in a Professional Development School (PDS) site. PDS is a public school-university partnership for teacher preparation that has inquiry at the core of the program's activities. Each teacher agreed to engage in at least three long interviews focused on the following issues: what an inquiry stance toward teaching looks like; how

an inquiry stance toward teaching may be cultivated; and how an inquiry stance toward teaching impacts their classrooms, schools, and the PDS partnership. Teachers in the study identified collaboration in a learning community as absolutely critical. The access to people and dialogue in a risk-taking environment is necessary for cultivating an inquiry stance toward teaching. The findings from both of these studies support a shift away from traditions of isolation to professional learning communities where professional development occurs for the teachers involved. A more deliberate structuring of professional learning communities that includes multiple perspectives was also found to be essential in order to strengthen the dialogue around inquiry questions. To stay true to an inquiry stance, teams must collaboratively develop norms, use protocols to examine data and distribute leadership responsibilities (Boudett, et al., 2008; Hathorn et al., 2008; Love et al., 2008). Collaborative inquiry is a cyclical process that encourages ongoing dialogue about teaching practices as well as student learning.

Nelson (2009) completed another study of PLCs in year two of the PRiSSM project with an in-depth analysis of three particular cases. Using the inquiry cycle consisting of *focus, implement* and *evaluate*, teachers collaboratively identified and implemented instructional strategies to address the gap between student learning data and teachers' learning objectives. The effectiveness of the strategy was monitored by qualitative data in the composition of case studies. The three cases had very different outcomes based on the groups' use of inquiry or not. In the first PLC, the teachers engaged as experts not learners. They focused on curriculum alignment rather than collaborative inquiry around student work and instructional strategies. The second PLC had established a norm around "niceness" which resulted in them sharing previous

classroom practices but never getting to raising questions about the efficacy of those practices. This group engaged as learners developing an understanding of the inquiry process but never collected or made sense of classroom data by asking difficult and uncomfortable questions. The analyses of these two groups indicated that the development of an inquiry stance is not easy or automatic in a PLC. The third PLC collectively analyzed student work in relation to a specific inquiry question which helped surface their beliefs about students, learning, and teaching. This group used common assessment data multiple times to redevelop instructional plans across all teachers' classrooms in order to monitor student progress. The work of these teachers highlights the potential for professional growth through collaborative inquiry. These examples of PLCs show the importance of teachers engaging in dialogue as learners. The key finding from this study, as well as the previous studies, was that sustained dialogue is an essential characteristic of PLC work. Yet the nature of the dialogue must be characterized by an inquiry stance to contribute to transformative learning with impacts on classroom instruction and student learning (Nelson, 2009).

From their work with the Partnership for Reform in Secondary Science and Mathematics (PRiSSM) teachers, Nelson et al. (2012) decided to more fully explore the notion of stance as an essential element for meaningful collaborative inquiry. Their work continued for two more years after the PriSSM project with seven PLCs consisting of secondary math and science teachers. The data process used in the PLCs consisted of the following four phases: *exploration, collection, analysis,* and *implications*. For this qualitative study, the researchers were "primarily interested in the stance that permeates group dialogue as teachers work together on student learning data" (Nelson et al., p.5).

They arrived at this objective after analyzing the case study reports from the PRiSSM project cited earlier and found that the topic and patterns of teachers' dialogue varied, as well as their perspectives on the use of classroom data. These differences led to the development of a conceptual framework for an inquiry stance. Data was collected during each phase of the data process in the form of field notes, observation, artifact collection, audio recordings, and interviews. Once each part of the process was coded, an additional set of codes was applied to just the analysis phase. Nelson et al. (2012) identified four ways that teachers invoke data when analyzing student learning: distributed data (evidence shared with all group members); referenced data (evidence available for one teacher who describes it to others); data in absentia (evidence previously analyzed and not physically available during discussion); and anecdotal data (general impressions from past experiences). A two dimensional conceptual framework was created (Table 2.1). The first dimension is a teachers' stance toward the use of student learning data that lies on a continuum from proving to improving. Nelson et al. (2012) describe a proving stance as an attempt by teachers to use the data to show strengths in their current practice rather than reflecting on potential changes and improvements to their practice. An improving stance was defined as engagement in a collaborative exploration of classroom practices based on the careful examination of student learning data. For the second dimension, the researchers developed a continuum to describe the nature of teacher interactions around student data. These interactions ranged from inquiry based talk consisting of questions and negotiations to disconnected talk that had little to do with the focus of the group (Nelson et al., 2012). The researchers concluded that if teachers don't move beyond collegial conversations to building on each other's comments, questions,

and actions then collaborative inquiry is not occurring. Based on their research, Nelson et al. (2012) discovered that teacher groups who enact an improving stance toward student learning data and who engage in negotiating conversations are able to reflect on their practice in a more purposeful way. The teachers' "stance" toward PLC work was what made the difference in how well they used data. Teams that had a proving stance used the data to convince themselves that what they were doing was right. Teacher teams that had an improving stance saw assessments as tools to better understand their students' thinking, tried new strategies to improve classroom practice and saw beyond their own classrooms. If collaborative inquiry is to become more than the latest trend in educational reform, school leaders will need to help groups realize the potential for transformative learning and impact on students (Nelson et al., 2012).

Table 2.1

Two Dimensional Conceptual Framework for Inquiry Stance

	Improving ←	Moving Toward	Moving Toward →	Proving
Dimension				
Stance	Nuanced	Learning-focused	Teaching-focused	Categorical
Dialogue	Inquiry-based	Exploratory	Connected	Disconnected

Collaborative inquiry has been shown to benefit not only veteran teachers, but novice teachers as well. Windschitl, Thompson, and Braaten (2011) used a qualitative multi-case study approach to research how involvement in systematic cyclical inquiry helped novice teachers improve their pedagogy. The study was conducted over two years and included 11 secondary science teachers engaged in tool-supported collegial analysis

of their students' work. Effective teams understand that there is a work flow inherent with the collaborative process (Bailey & Jakicic, 2012). The tools used were protocols to guide the dialogue and rubrics for analyzing students' evidence-based explanations in science. Windschitl et al. (2011) analyzed the data using the following codes: forms of discourse associated with the tool; interactions among participants around re-framing the problems that the focal participant had originally brought to the table; and interactions among participants that connected students' work with instructional decisions. The researchers noted distinctly different forms of engagement in the Critical Friends Group which they placed on a continuum ranging from "problems with students" to "puzzles of practice." This continuum of engagement is similar to the continuum of proving stance to improving stance presented by Nelson et al. (2012). About one-third of the group expressed a sense of disappointment in their students for failing to meet the expectations (problem with students). For these teachers the responsibility for performance rested with the students. In addition, these teachers' analysis of student work was very limited. Classroom data for these four teachers indicated that their instruction was characterized by teacher delivery of information. On the other end of the continuum, approximately one-third of the teachers had a genuine sense of curiosity phrased in terms of student thinking rather than student answers (puzzles of practice). These teachers took ownership for the students' lack of success and reflected on what they could have done differently to achieve different results. They also conducted a much deeper analysis of the students' work. The data from classroom observations of these five teachers showed that they were using an inquiry approach to teaching by having students reconstruct their own understandings to be more coherent with scientific ideas. This research indicates

that novice teachers are just as capable of productively analyzing data, engaging in reflective dialogue about student learning, and more importantly, enhancing their instructional repertoire as veteran teachers. The study with novice teachers (Windschitl et al., 2011) and Snow-Gerono's (2005) study with veteran teachers indicate that the number of years of teaching experience does not impact the teachers' ability to engage in collaborative inquiry. The key is for all teachers to have a shared understanding of the purpose and value of collaborative inquiry. Collaborative inquiry provides a decision-making and problem-solving environment necessary to support long-term change (Nelson & Slavit, 2008).

Powerful collaboration is a systematic process where educators work together to identify common challenges, analyze data, and test out instructional strategies in order to improve teaching and increase student achievement (David, 2008; DuFour, 2004b). Monitoring key teaching strategies for both implementation and effectiveness positions educators to make continuous instructional improvements. In a phenomenological case study, Pella (2012) addressed how teachers' collaborative analysis of qualitative forms of data, such as peer observation and student work samples, impacted their writing instruction. Over a two year period, five middle school English language arts teachers from diverse districts participated in nine inquiry cycles which included topic selection, lesson design, observation, debriefing and analysis of student work. The participating teachers engaged in a contextualized process known as lesson study where they investigated teaching and learning through a collaborative analysis of various forms of data. Pella (2012) used the content analysis and analytical induction method as well as the constant comparative method. For the analytic induction method, she tested

instances of the phenomena against her hypothesis that the collection and analysis of qualitative forms of data would foster the development of new knowledge for teaching writing. The researcher triangulated the data in order to code for themes that illustrated how participants' analysis of data influenced their pedagogy. All of the participants were frustrated with their districts' notion of collaborative inquiry and sought a professional development model where they could collaborate, investigate, and be reflective of their teaching. Unfortunately, the traditional culture of education still values autonomy and isolation, especially at the secondary level even though collaboration intuitively makes sense (Gruenert, 2005). The lesson study model provided the teachers with the collegial opportunities they were looking for and transformed their approach to writing instruction.

Identifying an explanation for student underperformance requires digging deep into the data and closely looking at student work. Levine and Marcus (2007) looked at the impact teacher collaboration had on adjusting instruction as well as closing the achievement gap. Meeting the diverse needs of students requires teachers to learn new instructional strategies. Teachers who engage in collaborative inquiry with regard to new approaches are likely to internalize the approach and are apt to value the shared practices (Levine & Marcus, 2007). This qualitative case study was conducted over two years and involved teams of teachers at two different high schools. The researchers' analyses of the data led them to question whether and how teachers publicly share their own practice, critique others and engage in conversations that will influence classroom instruction. Teachers typically value autonomy and avoid seeking opportunities to share with one another. This study concluded that training and structures must be put in place to help teams engage in difficult issues about teaching and learning, address biases about certain

groups of students and critique each other's practice (Levine & Marcus, 2007).

Reflecting on current practices and being open to new ideas is essential for a teacher's growth. Both teachers and students benefit when a school shifts from a culture of isolation to one of collaboration. Teachers learn best from their colleagues, in settings where they teach each other the art of teaching (Schmoker, 2004c). Even though there is ample evidence that supports teachers working in collaboration, teachers in many schools still work in isolation. The use of protocols to structure collaborative data analysis and the establishment of norms of participation are activities that teachers may need support with and are crucial to the inquiry process (Nelson & Slavit, 2008). Through collaborative inquiry, individual and collective actions become more intentional and evidence based.

Cultivating Effective Data-Driven Decision Making

For decades school accountability has been based on standardized test data. This has resulted in a focus on data-driven school improvement. The theory of action behind the No Child Left Behind Act is that educators have the know-how to analyze, interpret and use data to make informed decisions in all areas of education, from professional development to student learning (Wohlstetter, Datnow, & Park, 2008). Multiple studies have concluded that this is simply not the case; many teachers lack the capacity and expertise needed to use data to guide instructional decisions. Schools utilize data for instructional decisions such as identifying objectives, aligning instruction with standards, grouping and individualizing instruction, identifying low performing students, as well as monitoring student progress (Kerr et al., 2006).

The push for more systematic use of data to inform decision making in schools has emerged from two sources. As stated previously, the first is accountability measures where the value of public schooling is no longer to be assumed, it is to be demonstrated (Anderson, Leithwood, & Strauss, 2010). The second is the expectation of continuous school improvement that utilizes formative assessment to monitor student progress on a regular basis. Wohlstetter et al. (2008) looked at the role of the system in shaping and supporting instructional improvement through the use of student achievement data. The researchers did a triangulated qualitative case study of two urban school districts and two nonprofit charter schools. At each school within the systems, they interviewed the school leader and a minimum of five teachers, observed meetings and classrooms, and gathered several documents pertinent to the study. All of the schools indicated that data-driven decision making was not a reform that should be implemented in isolation, but rather cultivated at the systems level. Aligning goals, curriculum, and assessments was found to be essential for effective data-driven decision making. Establishing a culture of data use with explicit norms, expectations and built-in collaboration time was also a critical component. Since this study looked at the role of both central office and the school, a key finding was that central office support is important but educators at the school level ultimately need to be provided with sufficient decision making autonomy.

Anderson et al. (2010) conducted a mixed method study examining data use by teachers and principals at the school level. Data sources consisted of stratified random sample surveys of teachers and administrators, interviews with principals, and case studies based on interviews with district leaders, school administrators and teachers from six elementary schools they identified as high users of data for decision making. The

focus of their analysis was on types of evidence, organizational conditions that influence data use, and patterns of data utilization. The type of data available to teachers is often limited. Most schools provide externally mandated test data while some also have formative assessment information (Anderson et al., 2010). In terms of principal engagement in data use, both teachers and principals in this study believe that principals use data and provide a moderate amount of encouragement for data use by staff. This study found only a few settings where educators were moving beyond the use of data for problem identification to actual problem solving. Multiple research studies have emphasized the need for professional development that ensures that teachers have the knowledge and skills to effectively respond to problems identified through the collection, analysis, and interpretation of data (Anderson et al., 2010; Wohlstetter et al., 2008). It is not just the use of data that will make a difference in the quality of teaching and learning, rather it is the actions taken based on data-informed decisions. Many studies have identified organizational conditions that influence data use such as: (a) accessibility and timeless of data; (b) perceived validity of data; (c) staff capacity and support; (d) time for analysis; (e) partnerships with external organizations; (f) tools for both data collection and interpretation; (g) organizational culture and leadership; and (h) federal, state and district policy context (Anderson et al., 2010; Ikemoto & Marsh, 2007; Wohlstettter et al., 2008). The majority of the 27 principals in the study done by Anderson et al. (2010) conveyed an awareness of these conditions, but very few mentioned actions they had actually taken to put these conditions in place. Effective implementation of data-driven decision making requires strong leadership. Research suggests that analyzing school data to improve instructional practices should be non-negotiable across a school district and

that district leaders play a key role in selecting and organizing the kinds of data teachers and principals use to inform their work (Anderson et al., 2010; Wohlstetter et al., 2008). Therefore, the potential for effective data-driven decision making in relation to improved student learning might be highly dependent on support from district level leadership.

Data driven decision making is clearly not a straightforward activity. There are a variety of ways school districts are making decisions based on data that range from simple to complex. The way in which data is collected, how often, as well as the type and level of detail can vary greatly. In addition, the type (collective or individual) and frequency of data analysis conducted can be different. Depending on these circumstances, data driven decision making can be characterized as one of four types: *basic, analysis-focused, data-focused,* or *inquiry-focused* (Ikemoto & Marsh, 2007). Basic data driven decision making refers to the sole use of state test results to target areas of weaknesses. The other extreme is inquiry-focused data driven decision making which involves a collective effort and draws on multiple sources of data to probe into a particular problem of practice. Ikemoto and Marsh (2007) found instances of all four models in their studies but most educators used simpler forms that focused on narrow types of data which could ultimately lead to erroneous conclusions. All types can be useful; it just depends on the purpose and resources available.

Kerr et al. (2006) conducted a comparative case study examining the efforts to promote instructional improvement in three urban school districts that had a significant percentage of low-income and minority students. Researchers visited each district multiple times over a two year period. They interviewed central office administrators, principals, teachers, school board members, and union representatives. Other data

sources included observations of meetings, focus group discussions with teachers as well as a survey. The districts in the study implemented the following strategies to promote data use: school improvement planning, interim assessments, technology data systems, systematic review of student work, and structured classroom observations. Each district also received some form of professional development to support teacher and principal knowledge and use of data to guide instructional decisions. Two of the three districts made data-based decision making a district reform initiative. These districts invested more time and effort in the data use strategies they implemented and utilized a variety of data to inform their instruction. The degree of staff buy-in, perceived usefulness, and use of data was stronger in these two districts. Systematic review of student work was ranked the most useful type of data by all three of the districts. Kerr et al. (2006) identified the following factors affecting data use: state accountability incentives to examine student achievement data; accessibility and timeliness of data; perceived validity of data; lack of discretion to veer from district curriculum guides; and school personnel that lack the capacity to formulate questions, analyze results and develop solutions. During interviews many teachers in this study expressed the value of using multiple sources of data in the inquiry process. Research findings suggest that data-driven decision making is more powerful to teachers when multiple sources of evidence are used and educators collaboratively analyze the data. The literature suggests that the inquiry process can be a means for building capacity for school improvement in addition to promoting better decision making (Ikemoto & Marsh, 2007).

Providing structured time for collaboration is essential for data-driven decision making. Expectations for how collaboration looks and sounds needs to be clearly

communicated in order to make sure teams are productive. The purpose of team norms is to create a respectful environment that encourages diversity of ideas and close inspection of instructional practices (Peery, 2011). Several studies stress the importance of creating norms and rules for discussion about student work. Without protocols teams can easily get off track. Young (2006) conducted four embedded case studies to explore what constituted data in teachers' eyes and how organizational conditions shape teachers' use of data. She followed a grade-level team of teachers in four schools across two districts conducting interviews with district administrators, principals, teachers, and literacy coaches. Young also observed grade-level meetings, staff meetings as well as professional development sessions. The research found that agenda setting was a key leadership function for teachers' use of data. Agenda setting included articulating the expectations of how teachers utilize various forms of data, planning teachers' learning about effective data use and structuring time for teachers to collaboratively analyze data. In addition to agenda setting, the study found that certain collaborative norms strengthened teachers' efforts to use data. Only one school in the study had both a high level of leadership for teachers' data use and high collaboration. It was at this particular school that the teachers viewed the students as "our students" and saw their colleagues as valuable resources for their own professional growth.

Establishing norms early on allowed teachers from this school to question each other about student progress and instructional strategies. Each educator on the team regarded their colleagues as integral to their own success in the classroom. The differences between the four cases indicate that pre-existing norms and leadership strength shape whether collaborative conversations about data occur and to what extent

(Young, 2006). This case study found that school leaders that want to establish effective and systematic data use need to embed the improvement of teaching and learning in all data-related activities.

Similarly, Datnow (2011) investigated the current educational reform movement of data-driven decision making with respect to teacher collaboration. The qualitative case study looked at how two urban school systems integrated teacher collaboration as a key feature toward using data. Sites were chosen based on their record for improving student achievement over time and being leaders in data-driven decision making. Leaders in these districts directly tied the use of data to improving teaching and learning. The research team visited the two school districts multiple times over a two year time period. While at each of the sites, researchers interviewed two to three central office administrators, two to three school administrators, and teachers from a variety of grade levels and subject areas. In order to triangulate their findings, the team also observed in classrooms, conducted focus groups, gathered relevant documents and attended pertinent professional development workshops. Common across both districts was the administration and analysis of interim assessments aligned to state standards. The districts had structured time for teachers to collaborate on the interim assessments as well as other data sources. The data meetings also had specific protocols and norms in order to keep participants on task. Datnow (2011) judged the work in these two districts against Hargreaves' (1994) definitions of collaborative cultures and contrived collegiality. Datnow's research indicated that what began as contrived meetings to discuss data evolved into collaborative settings where teachers challenged each other, posed questions, and shared instructional strategies. From Datnow's study it is evident

that teachers need collaborative structures for data-driven decision making, but also the flexibility to actually implement changes in the classroom. Leaders need to intentionally direct conversations toward instruction or risk data analysis that is done merely as a compliance activity divorced from classroom practice (Young, 2006). These studies suggested that leadership agenda setting, collaborative norms and organizational capacity are all required for teachers to effectively use data.

Although schools are gathering more and more data, several schools lack a process needed to connect the data they have to the results they want to achieve. The following conditions are essential for successful data-driven decision making: a professional culture; collaborative inquiry; multiple data sources, including common formative assessments to target ongoing instruction; root cause analysis; and strong leadership (Love et al., 2008; Bernhardt, 2009). There are numerous models to support the effective use of data to make instructional decisions. As previously mentioned in Chapter 1, Boudett et al. (2008) support the Data Wise Improvement Process which has eight manageable steps organized into three phases: *Prepare, Inquire,* and *Act*. The first phase requires school to prepare for data analysis by establishing a collaborative culture. The second phase requires the teachers to inquire about patterns and trends as they dig deeper into student data and examine instruction. The last phase requires teachers to act by developing and monitoring an action plan. This model is a cyclical process that encourages further inquiry as other questions arise. Love (2004) has a similar cyclical model referred to as the Using Data Process, also noted in Chapter 1, which also supports a culture of collaborative inquiry. The components of this process are: building a foundation; identifying a student learning problem; verifying causes; generating

solutions; and implementing, monitoring and achieving results. Both of these data-driven decision making models foster collaboration and powerful conversations about data that lead to improved teaching and learning.

Using Assessment for Student and Teacher Learning

Educators effective of use of data is essential to school improvement. Yet all the data in the world will have no impact on student learning unless teachers feel confident and comfortable using multiple sources of data on a regular basis. Placing assessment, both formative and summative, within educational decision making is essential if assessments are going to have a strong impact on teaching practices (Graue & Johnson, 2011). Many of today's teachers lack the knowledge and skills for educational assessment. Until recently, teacher education programs did not require students to learn anything about classroom assessment (Popham, 2009). Assessments come in a variety of forms and range from informal teacher questioning to formal summative assessments like state tests. Regardless of the form of the assessment, one essential reason for teachers to administer these assessments is that they let the teacher know how well the students are progressing with the curriculum as well as inform subsequent teaching (Supovitz, 2012). Teachers who are genuinely assessment literate will not only know how to create quality assessments, but will also be able to effectively analyze results. Assessment literate teachers typically make better instructional decisions (Popham, 2009).

The term formative describes teachers' use of assessments rather than the assessments themselves (Young & Kim, 2010). Formative assessments are valuable for two reasons; they provide: (a) timely feedback to teachers on the effectiveness of their teaching so adjustments can be made to instruction; and (b) feedback to students on

concepts mastered as well as areas that need further development. In a study on how schools develop the capacity to utilize interim assessments the researchers found that formative assessment contributes to instructional coherence and improvements when embedded in a feedback system (Blanc et al., 2010). Nationally, the two assessment consortia funded by the federal "Race to the Top" program have chosen to include interim assessments as a component of their overall test design. Due to the reform movement, the use of interim assessments is becoming increasingly more prominent in schools. The first year of the qualitative study done by Blanc et al. (2010) there were ten schools selected based on the following criteria: data-driven decision making was a priority of school leaders; staff was engaged in ongoing professional development on organizing and using data; and grade level groups met regularly to discuss data. The study examined how these formal communities of practice made sense of data from benchmark assessments and how they used the information to rethink instructional practice. To do more extensive fieldwork, the sample was narrowed to an in-depth case study of five schools in the second year. The researchers observed meetings, attended professional development sessions, and interviewed staff. They looked at tools, people, and structures that have the potential to help practitioners develop shared understandings of goals and strategies to guide their work. The district curriculum, assessments, data analysis protocols and online data systems were some of the identified tools. The alignment of benchmark assessments with the curriculum offers opportunities for teachers to closely examine results to see how their pedagogical content knowledge can be strengthened. The researchers' observations of grade level meetings and interviews with educators indicated that changes in teacher instruction were rarely the focus of

teachers' analysis (Blanc et al., 2010). While curricular tools provide guidance to a school, the principal plays a critical role in fostering an environment where adult learning is central to school improvement (Blanc et al., 2010; Dufour, Eaker, & DuFour, 2005). The school leader assists by carving out time for teams to meet, collaboratively developing group norms and providing necessary resources. Principals and teacher leaders need strong facilitation skills to lead rich conversations that make data driven dialogue an opportunity for teacher learning. Structures such as a feedback system were found to be essential if interim data was to significantly contribute to changes in teaching and learning. The four steps in the feedback system are; (a) accessing and organizing data, (b) making sense of data to identify problems and solutions, (c) implementing the interventions, and (d) assessing and modifying the interventions (Blanc et al., 2010). The researchers' analysis indicated that the quality of the sense-making of data in instructional communities directly determined the quality of the actions taken by the educators. When classroom assessments are conceived as assessments *for* learning, rather than assessments *of* learning, both teachers and students are actively involved in the improvement process (DuFour, Eaker, & DuFour, 2005; Popham, 2009). By sharing results from a common assessment teachers quickly see which of their colleagues has been effective at teaching a particular skill or concept. The goal is that teachers would then replicate the strategy in their own classroom. School personnel in higher data-use schools are more likely to report that they use formative assessments aligned with state standards and district curriculum to monitor student progress and make instructional decisions (Anderson et al., 2010).

Teachers' pedagogical repertoire and subject matter knowledge pose a challenge when it comes to utilizing formative assessments both effectively and efficiently. Phelan, Choi, Vendlinski, Baker and Herman (2011) conducted a randomized, controlled study to see if a formative assessment intervention improved student performance in mathematics. The study had 85 teachers participating from 27 schools in seven school districts. The treatment group students received instruction and formative assessments while the comparison group students received their regular instruction. Based on district needs within and between school models were used. To measure student performance a pretest was administered and a transfer measure which used items from the Trends in International Mathematics and Science Study, National Assessment of Educational Progress, the Qualifications and Curriculum Authority Key Stage 3 exam, Programme for International Student Assessment, and benchmark tests from a pilot district was given at the end of the year. Phelan et al. (2011) found that a short amount of targeted intervention on key mathematical principles had some impact on student performance. Students in the treatment group performed substantially better on short and extended response questions. Students with higher pre-test scores tended to benefit more from the intervention compared to students with lower pre-test scores.

To summarize this section, formative assessments inform teachers' instructional decisions and serve as the basis for feedback to students to help them improve their learning (Love et al., 2008). Effective formative assessment must include valid assessments, instructional strategies linked to the content, as well as professional development to ensure that teachers know how to appropriately use the data from the assessments. School improvement requires teachers to engage in ongoing collaborative

analysis of student performance data from multiple sources. When teachers meet to evaluate results of assessment data, they begin to identify patterns of strengths as well as areas in need of improvement.

Chapter Summary

In this era of accountability, data-driven decision making has emerged as a prominent school improvement strategy, but based on the research there is still work to be done before schools are routinely using data to effectively inform instruction. Most educators have had very little preparation for productive analysis of data. The challenges stem from common and traditional school structures and teacher interactions. Traditional school cultures where critical conversations about teaching and learning occur are not the norm. Even though the concept of professional learning communities has been around for over a decade, PLCs are still extremely scarce. It is a rare school that has established regular meeting times for teachers to create assessments and refine their lessons and strategies together. These processes need to be standardized across schools within a district in order for collaborative teams to be effective. The impact of broader organizational contexts and institutional pressures impact the work of a teacher group (Nelson & Slavit, 2012). The research spoke to the use of data by teachers to inform their instruction, but not much was included on the role of the student in the data driven decision making process. More research is also needed on different strategies to build teachers' capacity to analyze student achievement data for information on student understanding.

The central premise of using data is that the information gleaned from an analysis can provide teachers with valuable evidence about student understanding. Reviewing,

analyzing and interpreting data is the foundation of professional learning communities. Professional learning communities have been found to be a promising practice in the area of teacher development. From the review of the literature it was discovered that if teachers are going to use data collaboratively, they need a common meeting time built into the school day to examine data, a plan for instructional improvement, and strong leadership. For groups to function at a high level the establishment of norms was found to be essential, as well as an inquiry stance. Based on the research, it is evident that if teachers are going to make data informed decisions, they need professional development on both data analysis skills and collaboration skills.

Chapter 3: Research Design Methodology

Introduction

Chapter 3 describes the research design and methodology that was used to conduct this mixed methods study. The first section reviews the association between the problem statement, research questions and design for the study. Subsequent sections provide a description of the study's research context, participant selection, instrumentation, procedures and data analysis.

General Perspective

The purpose of this concurrent mixed methods study was to examine the effect collaborative data analysis among educators has on teacher practice and student achievement. To improve both teaching and learning, schools must use data to make decisions about whether their students are meeting the standards; if not, then use data to change practices and monitor the effectiveness of those adjustments (Ingram et al., 2004). Technological advances have made collecting and disseminating data easier. As a result, teachers are often daunted by the amount of assessment data available to them. The problem is that many educators lack the training or experience in using data to make decisions and thus feel overwhelmed by the prospect. School districts need to proactively foster the use of data to guide educational decision making and practice. Educators are more likely to believe in the value of data if they have the skills to use them and witness positive results in student performance. Organizing the work of instructional improvement around a process consisting of specific, manageable steps helps educators

build confidence and skill in data analysis (Boudett, et al., 2005). Looking at data should be viewed as a process rather than an event. Sindelar (2003) suggested that consistent analysis of assessment data allows teachers to improve practice, which in turn, improves student achievement.

Strong evidence exists supporting the benefits of looking at student work, but further investigation is required as far as how teachers can learn to productively work together to monitor and achieve intended outcomes. When educators are involved in analyzing and interpreting data collaboratively, they become more invested in the school improvement efforts (Boudett et al., 2005). Yet, collecting and using data systematically does not occur naturally when teachers work together. Collegial conversations must not be confused with focused professional dialogue which is essential to school improvement (Schmoker, 2004a). Teachers need professional development on collaboration skills and how to have effective data-driven dialogue. Specific training in gathering data, making sense of the information and figuring out the instructional implications is essential (David, 2008). Inquiry teams must develop and utilize protocols to build the capacity and trust required for meaningful collaborative work. Levine and Marcus (2007) noted that when educators have the time, training, and structures for identifying the areas of challenge it opens up lines of communication and creates a community of learners.

Continuous improvement is a key factor in the NYS Regents Reform Agenda. In this era of accountability, data-driven decision making has emerged as a prominent school improvement strategy but based on the research there is still work to be done before schools are routinely using data to effectively inform instruction. Effective data-driven instruction requires quality assessments, analysis, action and most importantly a

collaborative culture (Bambrick-Santoyo, 2010). By studying how integrating formative assessment, data analysis and collaboration works, new insights may be gained which will expand understanding of data-driven decision making as well as lead to improved instructional practices and student achievement. This study was intended to answer the following research questions pertaining to collaborative data analysis by educators:

1. How does teacher participation in collaborative data analysis translate into improved instructional practices in the classroom?
2. How does teacher participation in collaborative data analysis improve student performance on state and local assessments?

A pragmatic lens was used in this study, as the researcher used multiple approaches for collecting and analyzing data to provide the best understanding of the research questions. A mixed methods research design was chosen for this study to better understand the research problem by triangulating numeric trends from quantitative data and the detail of qualitative data. Utilizing this method allowed the researcher to collect multiple forms of data at the same time and then integrate the information. The quantitative aspect of the study used a quasi-experimental approach to measure the effect of training in collaborative data analysis on both instructional practices and student achievement. A quasi-experimental approach was chosen because the researcher intended to establish a qualified cause-and-effect relationship using a nonrandomized design. At the same time, a qualitative case study approach was used to explore teacher's views on the effectiveness of collaborative data analysis with respect to instructional practices and student learning. The researcher chose a case study approach because it investigates, describes and explains a phenomenon within its real life context (Creswell,

2013). The use of a mixed methods design allowed the researcher to dig deeper with the analysis and make sense of the phenomena being studied from multiple data sources.

Research Context

The research context for this study included twenty suburban, public school districts located in the mid-west region of New York. Schools within this region represent a range of economic and demographic conditions. All of these school districts have been designated by the New York State Education Department as a district in "Good Standing." Table 3.1 provides a brief description of the participating schools districts.

Table 3.1

School Districts

School District	Approximate Enrollment	FRPL	Graduation Rate	CCR
D1	3,500	10%	94%	71%
D2	3,800	35%	84%	50%
D3	4,000	25%	93%	60%
D4	3,100	51%	89%	20%
D5	1,100	45%	81%	28%
D6	6,500	14%	94%	68%
D7	4,300	43%	85%	44%
D8	11,500	40%	84%	36%
D9	4,400	21%	90%	51%
D10	2,500	8%	97%	69%
D11	4,500	11%	94%	68%
D12	6,000	4%	97%	85%
D13	5,400	35%	85%	49%
D14	3,800	27%	90%	53%
D15	8,700	12%	94%	52%
D16	3,700	14%	92%	57%
D17	700	36%	91%	45%
D18	1,200	41%	84%	20%
D19	800	38%	85%	37%
D20	3,800	21%	87%	60%

Note. FRPL = Free and Reduced Price Lunch; CCR = College and Career Ready

At the center of the New York State (NYS) Regents Reform Agenda is the belief that students should graduate from high school prepared for postsecondary education and employment. The 2012 NYS graduation rate was 74% with only 35% of those students being considered college and career ready. To be college and career ready in NYS, students must achieve at least a 75 on the English Language Arts Regents exam and at least an 80 on one of the mathematics Regents exams (NYSED, 2012b). Although the suburban school districts in the mid-west region of New York had an average graduation rate of 90%, a substantial number of those students were not considered college and career ready. Specifically with regards to mathematics, only 58% of the students achieved the new aspirational performance measure of 80. Based on this data and the required implementation of the new Common Core Learning Standards (CCLS) for Algebra I during the 2013-2014 school year, the academic content of mathematics was chosen for this study. As the initial mathematics course in high school, Algebra is considered the "gatekeeper" course for all students. Success in this course can determine if they are meeting the college and career ready standard and more importantly, it lays the foundation for future math courses. The suburban school districts in the mid-west region of New York have achieved great success at getting students to pass and receive credit toward graduation on the Integrated Algebra Regents exam with a score of at least 65. Data from the June 2013 Integrated Algebra exam indicated that 90% of the students in the mid-west region of New York achieved a 65 or higher. However, the bar has been raised and a score of 65 is no longer considered proficient on a mathematics exam. To be proficient, a student now needs to score 80 or higher. This more rigorous benchmark

brought the percent of students reaching proficiency on the June 2013 Integrated Algebra exam in the mid-west region of New York down to 60% (NYSED, 2012b).

Research Participants

For purposes of this study, both teachers and administrators from select suburban school districts in the mid-west region of New York were included. Information about the study was shared with the Assistant Superintendent for Instruction in all of the suburban school districts in the mid-west region of New York. Those individuals decided if the school district would be involved in the study and if so, determined the teachers and administrators who would participate in the study. Educators from the same school district formed a collaborative inquiry team consisting of three to five members. Specifically, the collaborative inquiry teams were comprised of secondary level administrators and mathematics teachers. The reason for a purposive sampling design was to ensure that participants had similar roles and experiences to meaningfully contribute to the study. Vogt and Johnson (2011) define a purposive sample as a sample composed of subjects selected deliberately based on certain characteristics that are representative of the population who can provide information that cannot be obtained from other sources. Since the content area of mathematics was chosen for this study, the purposeful selection of math teachers for the collaborative inquiry teams was essential. As long as the majority of the members of the team were mathematics teachers, the varying number of team members on a school district team did not influence the outcome of the study. All school districts and participants from each of the collaborative inquiry teams were involved in the quantitative research methods for this study. Since the school inquiry teams received the intervention they were the experimental group. The control

group was the remainder of the school districts in the region that did not participate in the workshop.

For the qualitative component of the research, a convenience sample consisting of four Algebra I teachers from one district's collaborative inquiry team was chosen. Selecting participants for the case study in this manner is considered a convenience sample because the subjects were selected from a group of people that were already actively involved in the research study and therefore it was easy to obtain their consent to participate. Each of the four educators was interviewed separately to provide an in-depth understanding of the collaborative data analysis process and the implications for instruction from a teacher's perspective.

Instruments Used in Data Collection

The strategies of inquiry used for this mixed methods design were quasi experiments and a case study. In quasi-experiments, the researcher uses control and experimental groups but does not randomly assign participants to a group (Creswell, 2009). For this study, the experimental group was comprised of teams of selected educators from school districts involved in the Communities of Practice: Algebra I workshop series focused on the collaborative data analysis process. The control group was comprised of similar districts in the mid-west region of New York that did not attend the collaborative data analysis training. The independent variable for the quasi experiments was the collaborative data analysis conducted by teams of teachers and administrators from a school district. Over the course of this study, the school teams participated in a three day workshop series that trained the teachers and administrators in collaborative data analysis methods, met regularly back at school and were provided

technical assistance as needed by the workshop presenters. The content of the workshop series was designed to support schools districts in creating a positive culture of shared leadership and high-level data use (see Appendix A for workshop agendas). School teams constructed meaning from deepening their understanding of the Common Core Learning Standards (CCLS) for Algebra I, analyzing student data and participating in on-going reflective dialogue about their practice. The following were the intended outcomes of the workshop:

- Establish a collaborative culture
- Learn protocols for effective and efficient data use
- Engage in data-driven dialogue
- Plan rigorous lessons aligned to the Algebra I CCLS and Mathematical Practices
- Develop standards-based formative assessments
- Analyze district, school and classroom data to inform instruction
- Learn how to actively involve students in the assessment process
- Learn how to provide meaningful and appropriate feedback to students

To explore and understand the collaborative data analysis process in-depth from the participant's perspective one team of teachers was chosen as a case study. From that school team, the Algebra I mathematics teachers were interviewed to collect detailed views from collaborative data analysis workshop participants about their experiences.

Several instruments were used to gather data for this mixed methods research study. The instruments used were a self-report rubric, Algebra Regents exams and

interviews conducted by the researcher. The data collected from the various instruments were analyzed to identify patterns and themes.

The first instrument for data collection was the Data-Driven Instruction and Assessment Implementation Rubric (see Appendix B), adapted from Paul Bambrick-Santyo and New Leaders for New Schools (Bambrick-Santyo, 2010). The rubric was designed for educators to evaluate the school's overall progress in implementing data-driven instruction. The rubric consists of four categories: (a) data- driven culture, (b) assessments, (c) analysis, and (d) action. All of the categories are considered important for inspiring a collaborative school culture. Within each of those categories participants were asked to reflect on five statements which are indicators of success and rate the level of implementation on a scale from 1 to 4. The ratings are as follows: 4 = exemplary implementation, 3 = proficient implementation, 2 = beginning implementation, and 1 = no implementation. The data from the rubric enabled the researcher to provide a numeric description of the findings. The rubric was intended to assess the present state of data-driven instruction and assessment in a school in relation to the key components of collaborative data analysis. All participants from a school team completed the rubric on the first day of training and then again toward the end of the study. Median scores for each team were calculated for both the pre and post administration of the rubric and were then compared. The outcomes of the rubric are the dependent variable in this part of the study.

The second quantitative instrument was the New York State Regents exams in mathematics; specifically the June 2013 Integrated Algebra exam and the June 2014 Algebra I exam. NYS Regents exams can be found at http://www.nysedregents.org/.

Student assessment scores on these mathematics exams were used to gather data relative to the impact teacher collaborative data analysis had on student achievement. The test specifications for the two Regents exams are shown in Tables 3.2 and 3.3.

Table 3.2

June 2013 Integrated Algebra Test Specifications

Question Type	Number of Questions
Multiple-choice (2 credits each)	30
2-credit open-ended	3
3-credit open-ended	3
4-credit open-ended	3
Total Credits	87

Table 3.3

June 2014 Common Core Algebra I Test Specifications

Question Type	Number of Questions
Multiple-choice (2 credits each)	24
2-credit open-ended	8
4-credit open-ended	4
6-credit open-ended	1
Total Credits	86

The June 2013 NYS Integrated Algebra results were used to determine the correlation between the June 2013 scores and the June 2014 scores. The June 2014 scores were the dependent variable for this portion of the study.

In addition to the above mentioned quantitative data, qualitative data was collected using semi-structured interviews. Kvale and Brinkman (2009) define a semi-structured interview as "an interview with the purpose of obtaining descriptions of the life world of the interviewee in order to interpret the meaning of the described phenomena" (p.3). The interviews for this research study were used to elicit views and perspectives from the participants in regards to the implementation and effectiveness of collaborative data analysis. A semi-structured interview is conducted according to an interview guide with suggested questions that focus on certain themes. However, the interviewer can also decide to follow-up on the interviewee's answers (Kvale & Brinkman, 2009). This format was selected because it allowed the interviewer to ask not only structured questions but also probing questions to obtain additional information for clarification on the topic. Individual interviews were conducted with four math teachers from the same school district who participated in the collaborative data analysis training. Interviews were used to gain understanding of individual teacher thoughts, feelings and experiences with collaborative data-driven decision making.

An interview protocol was used for asking questions and recording answers (see Appendix C). One face- to- face interview lasting approximately 30 minutes in length was conducted separately with each teacher. The interviews were recorded and professionally transcribed to ensure accuracy. The audio files will subsequently be deleted after three years to guarantee confidentiality.

Data Analysis

This research study utilized multiple data collection procedures. Upon approval from both the St. John Fisher College Dissertation Committee and the St. John Fisher Institutional Review Board (IRB), an email was sent to the Assistant Superintendents and potential participants regarding the purpose of the study. Attached to the email was an informed consent form for participants to sign before engaging in the research study. The form was used to ensure confidentiality to the participants as well as school districts and assure them that they could withdraw at any time.

The research activities for this study were conducted over a 10 month period from September 2013 to June 2014. Throughout that time span participants in the experimental group attended three days of collaborative data analysis training and met regularly back in their districts. The professional development covered the following topics: data-driven dialogue, task deconstruction, formative assessment, verifying causes, developing an action plan, deep analysis of the Common Core Algebra I standards, as well as the shifts in mathematical pedagogy as a result of the CCLS. The timeline and specific procedures for the study are outlined in Table 3.4.

Table 3.4

Procedures Used for Data Collection

Timeframe	Procedures
September 2013	- Collect June 2013 Integrated Algebra Regents data - Determine Participants - Identify Control Group
October 2013	- Day one of Collaborative Data Analysis Workshop - Data-Driven Instruction & Assessment Implementation Rubric (pre-test) completed by participants. Calculate the median score for each district.
November 2013	- Day two of Collaborative Data Analysis Workshop
February 2014	- Day three of Collaborative Data Analysis Workshop
March – May 2014	- Follow-up visits to participating schools as needed - Data-Driven Instruction & Assessment Implementation Rubric (post-test) completed by participants. Calculate the median score for each district and compare with pre-test data. - Interviews conducted individually with four mathematics teachers. Interview recordings transcribed. Coding and categorizing text from interviews.
June 2014	- Collect June 2014 Algebra I Regents data. - Conduct an independent samples *t*-test of the mean difference of the scaled scores for the exam.

Data collection and analysis occurred throughout the study as the different types of data become available to the researcher. For data collection purposes, and to protect confidentiality of the data, school districts were assigned a numerical code. Using descriptive statistics, teacher scores from the same district were then averaged to find the

median score for each component of the rubric. Using the scores from both the pre and post administration of the rubric, the Wilcoxon Signed-Ranked Test for matched pairs was used to determine the statistical significance the Communities of Practice: Algebra I workshop series had on participants' perspectives of each of the four components of the implementation rubric.

Student performance data on the June 2014 Common Core Algebra I Regents exam were analyzed to see if students in the school districts who participated in the Communities of Practice: Algebra workshop series achieved better results in 2014 than the districts who did not participate. First, a univariate analysis of variance (ANOVA) was completed to compare the mean scale scores of the control group and the treatment group. Next, a Pearson correlation coefficient was calculated for the relationship between the districts' June 2013 Integrated Algebra Regents exam scores and their June 2014 Common Core Algebra Regents exam scores. Since the sample was not random or normally distributed, the scores were changed to ranks so nonparametric test procedures could be used. A simple linear regression was calculated to predict districts' June 2014 Algebra I scores based on their June 2013 Integrated Algebra scores. Then using the ranked June 2014 data with the June 2013 data removed, a *t*-test was used to examine the difference between the mean ranked scores.

For the qualitative aspect of this study, once the interview recordings were transcribed, the researcher read over each of the texts and took notes to get a sense of the overall picture. From there, the researcher began a typological analysis using a coding process. Coding is the process of organizing the text into small categories of information (Creswell, 2013). The researcher coded the interview data using a priori codes to capture

the perspectives of the teachers around particular topics (Hatch, 2002). Next, the main ideas of each typology were record on a summary sheet. Emerging themes across all interviews were identified as well as powerful examples from the data that illustrate those themes.

Summary

A mixed methods research approach was utilized to gather multiple sources of both quantitative and qualitative data. The Data-Driven Instruction and Assessment Rubric, student performance data and interviews allowed the researcher to integrate the data to interpret the impact collaborative data analysis has on teacher instructional practices as well as student learning. In this concurrent mixed methods study the researcher was able to use the qualitative data to support or disconfirm the quantitative results. A broader perspective on the study was achieved by using a mixed method approach.

Chapter 4: Results

Introduction

As stated in Chapter 1, the purpose of this study was to examine the impact ongoing collaborative data analysis has on teacher practice and student achievement. This chapter presents the results of the study based on a statistical analysis of student achievement data and responses to the Data-Driven Instruction and Assessment Implementation Rubric, as well as a typological analysis of four personal interviews. The chapter is organized in four sections. The first section discusses the quantitative analysis and results to the responses to the Data-Driven Instruction and Assessment Implementation Rubric. The second section describes the quantitative analysis and results of the student performance data on both the June 2013 Integrated Algebra Regents exam and the June 2014 Common Core Algebra I Regents exam. The third section discusses the qualitative analysis and results of four interviews with teachers. The final section provides a summary of the chapter.

Quantitative Results: Implementation Rubric

The first research question asked: how does teacher participation in collaborative data analysis translates into improved instructional practices in the classroom? Research question one was partially answered by the responses to the Data-Driven Instruction and Assessment Rubric. Eleven of the 20 school districts included in this study participated in in the Communities of Practice: Algebra I workshop series. Teachers and

administrators from each of school districts completed the Data-Driven Instruction and Assessment Implementation Rubric both pre and post-workshop. The rubric is separated into four components: culture, assessments, analysis, and action. Within each of those components participants were asked to reflect on five statements which are indicators of success and rate the present state of data-driven instruction and assessment in their schools on a scale from one to four. The ratings are as follows: 4 = exemplary implementation, 3 = proficient implementation, 2 = beginning implementation and 1 = no implementation. The median was calculated for each component by district. The pre and post workshop rubric component median scores by district are shown in tables 4.1 and 4.2.

Table 4.1

Pre-Workshop Data-Driven Instruction & Assessment Implementation Rubric Scores

School Districts (N = 11)	Culture	Assessment	Analysis	Action
D20	1	1	1	1
D7	2	2	1	2
D8	2	3	2	2
D4	2	3	2	2
D14	2	4	2	2
D9	2	3	2	2
D5	1.5	1.5	2	2
D12	2	2	1	2
D13	2	3	3	2
D19	2	3	2	3
D18	2	2	2	2

Note. Scores represent median score by district. Rubric scores range from 1-4.

Table 4.2

Post-Workshop Data-Driven Instruction & Assessment Implementation Rubric Scores

School Districts	Culture	Assessment	Analysis	Action
D20	2	4	2	2
D7	2	3	2	2
D8	2.5	4	2.5	3
D4	2	3.5	2	2
D14	2.5	3.5	2.5	2.5
D9	2.5	3	2	2
D5	3	3	3	3
D12	2	2.5	2	2
D13	3.5	3.5	3	3
D19	2.5	3.5	2.5	2.5
D18	2	2	2	2

Note. Scores represent median score by district. Rubric scores range from 1-4.

The Wilcoxon Signed-Ranked Test for matched pairs was used to determine the statistical significance the Communities of Practice: Algebra I workshop series had on participants' perspectives of each of the four components of the implementation rubric. First, a change score was found for each pair of rubric scores. The change scores were then ranked and given a + or – sign. These signs indicated whether a district's second score turned out to be higher or lower than the first score. Next, the sum of both the + and – ranks were found. Finally, the sum of the ranks that had the least frequent sign was labeled as *W,* which was the calculated value. The *W*-value was then compared to a

tabled critical value at $p \leq 0.05$. When the data-based value of W is equal to or smaller than the tabled critical value the result is considered significant. The level of significance was set at 0.05 for all statistical analysis in this study. Table 4.3 shows the W-values and critical values for each of the rubric components calculated by the Wilcoxon Signed-Rank Test.

Table 4.3

Data-Driven Instruction & Assessment Implementation Rubric
Wilcoxon Matched-Pairs Signed-Rank Test Results

Components	Pre-workshop Median	Post-workshop Median	Growth (min, max)	W-value	Critical Value
Culture	2	2.5	(0, 2)	0*	2
Assessments	3	3.5	(0, 1)	3*	5
Analysis	2	2	(0, 2)	0*	2
Action	2	2	(0, 2)	1.5	0

Note. * $p \leq 0.05$

Creating a collaborative data analysis culture requires: (a) active leadership; (b) effective training for both teachers and administrators on data-driven instruction, as well as ongoing professional development; and (c) time for assessment, analysis, and action that is embedded in the structure of the school schedule (Bambrick-Santoyo, 2010). For the culture component of the rubric the results of the Wilcoxon Signed-Rank test indicated there was a statistical significance since the W-value of 0 was less than the critical value of 2 when $p \leq 0.05$. These results suggested that the Communities of Practice: Algebra I workshop series positively improved the present state in terms of a data-driven culture in the participants' school districts. The median score of 2.5 the second time the rubric was completed indicated that on average these districts were

somewhere between beginning and proficient with their implementation of a data-driven culture.

Based on the Implementation Rubric, Bambrick-Santoyo (2010) believes assessments should be written before the teaching begins, aligned to the state standards, apply to all students in a course, and periodically reassess previously taught content. For the assessment component of the rubric the results of the Wilcoxon Signed-Rank test indicated there was a statistical significance since the W-value of three was less than the critical value of five when $p \leq 0.05$. These results suggested that the Communities of Practice: Algebra I workshop series positively improved the present state of assessments that inform instruction in the participants' school districts. The median score of 3.5 the second time the rubric was completed also indicates that on average, these districts are somewhere between proficient and exemplary with their implementation of common assessments aligned to the state standards.

Bambrick-Santoyo (2010) stated that data analysis involves immediate turnaround of assessment results in user-friendly reports where the teacher's analysis can move beyond *what* students got wrong to answer *why* they got it wrong. For the analysis component of the rubric, the results of the Wilcoxon Signed-Rank test indicated there was a statistical significance since the W-value of 0 was less than the critical value of 2 when $p \leq 0.05$. These results suggested that the Communities of Practice: Algebra I workshop series positively improved the present state of data analysis in the participants' school districts. The median score of 2 the second time the rubric was completed, indicates that on average, these districts are beginning to implement data analysis practices.

Successful action plans are based on correct analysis, the development of new teaching strategies, the implementation and monitoring of the effectiveness of those strategies, and most importantly, engagement of students in the feedback process (Bambrick-Santoyo, 2010). For the action component of the rubric, the results of the Wilcoxon Signed-Rank test indicated there was no statistical significance since the *W*-value of 1.5 was greater than the critical value of 0 when $p \leq 0.05$. These results suggested that the Communities of Practice: Algebra I workshop series may not have improved the present state of action planning based on data analysis in the participants' school districts. The median score of 2 the second time the rubric was completed indicates that on average these districts are just beginning to implement action plans.

Quantitative Results: Student Performance Data

The second research question asked: how does teacher participation in collaborative data analysis improve student performance on state and local assessments? To answer this question student performance data on the June 2014 Common Core Algebra I Regents exam were analyzed to see if students in the school districts that participated in the Communities of Practice: Algebra workshop series achieved better results in 2014 than the districts that did not participate. Table 4.4 shows the mean scale scores for all of the districts on both the June 2013 and June 2014 exams. Important to note is that the Algebra course curriculum changed in 2014 to be aligned with the New York State Common Core Learning Standards.

Table 4.4

Mean Scale Scores on the June 2013 Integrated Algebra Regents and June 2014 Common Core Algebra I Regents

School Districts	June 2013 Mean Scale Score	June 2014 Mean Scale Score
D1	83	81
D2	80	75
D3	82	80
D4*	74	75
D5*	78	78
D6	85	85
D7*	76	71
D8*	75	74
D9*	80	79
D10	84	79
D11	84	77
D12*	88	79
D13*	80	80
D14*	80	80
D15	81	75
D16	80	80
D17	74	74
D18*	70	70
D19*	78	74
D20*	82	75

Note. * Districts that participated in Communities of Practice: Algebra workshops. Scale 0-100

First, a univariate analysis of variance (ANOVA) was completed to compare the mean scale scores of the control group and the treatment group. The independent variable was "group" which represented the two different groups and the dependent variable was "outcome" which represented the scores on the June 2014 Algebra I Regents exam. The mean and standard deviation for each group is shown in table 4.5. An independent-samples *t* test comparing the mean score of June 2014 Algebra I Regents exam for the school districts that participated in the workshop to the mean score of school districts that did not participate was not significant ($t(18) = 1.595$, $p > .05$). However, a more sensitive test of the workshop effect would remove the effects of the prior year's achievement from the 2014 data, which is reported below.

Table 4.5

Descriptive Statistics

Group	Mean	Standard Deviation	N
Control	78.44	3.54	9
Treatment	75.91	3.53	11
Total	77.05	3.68	20

A Pearson correlation coefficient was calculated for the relationship between the districts' June 2013 Integrated Algebra Regents exam scores and their June 2014 Common Core Algebra Regents exam scores. A strong positive correlation was found ($r(18) = .723$, $p < .001$), indicating a significant linear relationship between the two exams.

The statistical techniques applied to the data up to this point have the following underlying assumptions associated with them: (a) each sample is a random subset of the population, and (b) each population is normally distributed in terms of the dependent variable being focused on in this study (Huck, 2012). Both of those assumptions were violated in this study. As a result, the scores were changed to ranks as the nonparametric test procedures developed for use with ranks involve fewer assumptions (Huck, 2012). Using the ranked data, a simple linear regression was calculated to predict districts' June, 2014 Algebra I scores based on their June 2013 Integrated Algebra scores. A significant regression equation was found ($F(1,18) = 19.698$, $p < .001$, with an R^2 of .523. Standardized residual scores were saved from this analysis thereby creating a 2014 outcome variable with 2013 influence removed. Then, using the ranked June, 2014 data with the June, 2013 data removed, a *t*-test was used to examine the difference between the mean ranked score of the school districts that participated in the Communities of Practice: Algebra I workshop series, and the mean ranked score of the districts that did not participate. No significant difference was found ($t(18) = .509$, $p > .05$).

The quantitative student performance data indicated that the teachers' participation in the Communities of Practice: Algebra workshop series did not significantly influence their students' performance on the Common Core Algebra Regents exam.

Qualitative Results: Interview

This section explains the results from the analysis of interviews with four teachers from one of the school districts that participated in the Communities of Practice: Algebra training. The central purpose for the qualitative portion of this study was to further

explore the teachers' perspectives on collaborative data analysis in regards to their instruction as well as student performance. Therefore, both research questions were addressed through the interviews. The qualitative data was collected through semi-structured interviews and a typological analysis of the interview transcripts. The four teachers in the purposive interview sample all teach Algebra I. Brenda and Lisa both teach general education classes, Allison teaches special education classes and Gina is a mathematics coach. (The names of the teachers were changed for the purpose of retaining anonymity).

A review of the literature as well as the Data-Driven Instruction and Assessment Implementation Rubric were used to develop categories and a priori codes which were then used to divide the interview data into elements (Hatch, 2002). Entries by typology were then read to capture the main ideas and eventually identify themes. The following themes were identified after an extensive analysis: (a) data collection, organization and analysis takes time but the information learned is invaluable; (b) trust is an essential factor for successful reflective dialogue among teachers; (c) instructional practices are modified as a result of collaborative data analysis; and (d) learning targets and common assessments make collaborative data analysis more meaningful.

Data collection, organization and analysis are time consuming but valuable. The interview participants identified both challenges and advantages to collaborative data analysis. Each of the teachers identified time as the biggest challenge to the process: time to gather the data as well as finding time to meet with colleagues to analyze the data. Lisa shared that one of the challenges of the collaborative data analysis process is

"finding the time when different people can meet. If you don't set aside that time most often the data doesn't get looked at" (Interview #4, March 26, 2014).

A teacher's workday involves teaching multiple classes or subjects, writing lesson plans, correcting student work, attending school meetings and providing extra help to students. If teachers are to truly invest in collaborative data analysis practices, protocols as well as structured time to meet must be scheduled during the workday. Expecting teachers to grab time during breaks, from lunch or after school does not work; the level of conversation, sharing and planning that needs to occur during data team gatherings requires formal scheduled meetings (Anderson, 2010). Gina also identified, "charting out the error analysis" as a task that takes a tremendous amount of time and went on to say that support from building administration is essential: "We have been fortunate that our principal protected the math common planning time in the schedule this year. I will cross my fingers that it continues." (Interview #1, February 27, 2014)

Both Lisa and Gina's comments suggested that collaborative data analysis most likely would not occur if their principal had not designated a specific time in the schedule for their team to meet. Common planning time is vital if teachers are going to have rich data-driven discussions. Chou (2011) stated that school leaders must provide teachers with the necessary time, structures, and support to help them refine their pedagogy. Collaborative data analysis allows teachers to gain insight into their students' misconceptions and provides them time to reflect on their instructional practices.

The opportunity to compare instructional strategies and learn different approaches to teaching were some of the advantages to collaborative data analysis identified by the

teachers who were interviewed. Teachers were processing the information together and sharing ideas with one another as Allison noted:

> I get ideas from talking in our group. We have solved math problems together, modeled for each other how we teach it or what we think would be best practice. We also provide students with models and exemplars based on what we as a team had discussed in terms of what good work looks like. (Interview #2, March 4, 2014)

Based on Allison's statement, she appeared to value the opportunity to work through and discuss tasks with her colleagues both prior to and after teaching a lesson to her students. Educators' working closely together has been seen as a positive experience for these teachers. They met regularly and discussed which strategies worked and which did not. Brenda feels lucky that she is in a group that works well together:

> We are able to discuss daily lessons, what went well and what didn't. We talk about warm-ups, classwork, as well as how one teacher might have approached the lesson differently than others. We actually had a conversion today about one teacher doing one method and the other teacher doing another method so we could compare results. (Interview #3, March 11, 2014)

This comment suggested that Brenda and the other teachers were comfortable challenging each other to come up with the best instructional approach for a given learning experience. Collaboration introduces a new dynamic to data analysis where the interaction between participants reveals solutions and strategies that would not be evident without diverse perspectives (White, 2011). Lisa expressed the following advantages to collaboration:

> During the School Based Inquiry Team process you get to discuss different teacher's ideas, approaches and points of view as well as all the valuable information you get from looking at the data. I like having the time to look at data and compare my data to other teachers so we can look for commonalities and differences. (Interview #4, March 26, 2014)

This school district referred to collaborative data analysis as the school based inquiry process. Lisa seemed to appreciate the process for the opportunity it provided to learn from colleagues whose students might have performed better than hers on the same assessment. Teachers in this school district welcomed the professional development that ensues when teachers are provided the time to work together. As Levine and Marcus (2007) found, teachers who engage in collaborative inquiry with regards to new approaches are more apt to use different instructional strategies and value the shared practices.

Trust is an essential factor. For true reflection to take place the discourse environment needs to be one of trust, respect, inquiry and a willingness to learn. Each of the interview participants voiced that collaborative data analysis requires strong, trusting relationships with peers. Teachers in this district have developed a trusting culture where they felt comfortable asking each other critical questions. According to Allison, teachers also regularly visit each other's classrooms:

> We are in each other's classroom often that is just part of our team culture. I think we want to be in there so we are all using the same language and have the same expectations. Our team is really consistent. We are thinking a lot about what we are doing, why and for whom. (Interview #2, March 4, 2014)

Allison's comment suggested that the teachers on her team have developed such a high level of trust that they are able to observe each other teach, which is most likely not the norm in most schools. These teachers have really taken the collaborative process to the next level by watching and learning from being in each other's classrooms. The collaborative data analyses as well as the observations have made the teachers more reflective about their own instruction. Lisa saw the process as a way to reflect upon and improve her practice:

> If most of my students didn't do well with a particular problem on a test, then I can address whether or not I taught it well, what can I do differently, what I need to add to my notes, or what activities do I need the students to be able to do so they can master this concept. It has affected my everyday practice. (Interview #4, March 26, 2014)

Lisa appeared to be focusing in on the needs of her students during collaborative data analysis and reflecting on what instructional next steps would lead to increased conceptual understanding for them. Reflective dialogue is a powerful strategy for improvement. Data of any kind are only meaningful when teachers collaboratively examine, analyze, reflect, and ultimately decide to act on the data (White, 2011). Teachers were engaging in inquiry and having deeper conversations about their practice as expressed by Allison:

> There is more data to look at, not just your own classroom data but a wider pool to analyze and look for trends. The conversations have definitely changed for the better, they are deeper and richer. We actually have conversations about what we are hoping to do and see in the classroom. (Interview #2, March 4, 2014)

Allison's comments suggested that as a result of the school based inquiry process, teacher conversations about student achievement and instruction have moved beyond a superficial level of discussion. These teachers used to talk in generalities about student performance, now they were able to look more closely at each other's data as well as actual student work. Teachers were deconstructing tasks to identify the knowledge, skills and concepts being assessed, as well as looking for frequently missed questions and student misunderstandings. To have that level of dialogue requires a strong sense of trust among the group members.

Collaboration leads to modified instructional practices. Teachers were purposefully using the data to make future instructional decisions. Gina explained how they were dedicating class time to work specifically on skills that students have not mastered:

> We break the students into appropriate groups. What are the kids missing? What is the actual thing they need to practice? We talk about the most important things that we should hit upon during the next class. We put those concepts on weekly review sheets and warm-ups because those skills are going to affect them the rest of the course. (Interview #1, February 27, 2014)

Individual student needs are most likely being met based on the instructional adjustments mentioned by Gina. These teachers appeared to be using the information to identify student misconceptions in order to reteach the whole class or individual students. One of the greatest benefits of the data analysis process is collaboration to develop strategies and interventions when students are not meeting expectations (Anderson, 2010). This school has also created a schedule where there were two teachers in the math classroom every

day which has allowed them to provide more targeted instruction to smaller groups of students. Allison made the following comment about differentiating instruction, "with multiple adults in the classroom, we have definitely done a lot more grouping based on our data. For lack of better words low, medium and high groups" (Interview #2, March 4, 2014). Based on this data teachers seemed to be devoting more time to differentiating lessons, utilizing small group instruction and taking advantage of having multiple teachers in the classroom. Allison's comment appeared to suggest that their ability to provide small group instruction is because of the number of adults in the classroom. This school district was fortunate to have more than one teacher in the classroom to support the diverse needs of the students. In most classrooms the teacher is expected to differentiate instruction without the assistance of other teachers.

The first year of implementing the Algebra I Common Core Learning Standards (CCLS) has also forced these teachers to adjust their instruction. Teachers were creating common core aligned learning tasks and assessment questions. Brenda spoke about the types of questions they are creating as well as how they are stepping back as teachers and having students grapple more with the problems:

> We are giving students the new common core based questions and forcing them to problem solve and complete them without help from the teacher. Even our advanced students want that step by step approach; they want to know the answer and to make sure their answer is right, so they are not always willing to take a chance and experiment. It is really hard to step back and not be that front person. We are putting more of the common core questions into everyday practice and similar ones on unit tests. You don't want them to be the same because you want

the test question to be something they have to think about. (Interview #3, March 11, 2014)

Brenda's comment suggests that the rigor of the common core standards have made the teachers rethink the types of questions posed to students as well as move away from being "the sage on the stage" to more of a facilitator of learning. Teachers were creating new and novel problems for students to solve daily in the classroom. These types of instructional adjustments are exactly what the CCLS demand. The CCLS have required the teachers to work together and to change their practice. The teachers were trying not to scaffold the work for the students, but rather have the students reading, analyzing and persevering through the problems. The teachers were proactively planning units by looking at the standards to be learned and identifying the prerequisite skills necessary for success.

Data analysis is more meaningful with common assessments. Since June, 2014 was the first year the students were to be assessed on the Common Core Learning Standards for Algebra the teachers did a thorough analysis of the Standards for Mathematical Practices as well as the content standards during the workshop. Teachers began to create rigorous common core aligned questions to be used as formative assessments. The interview participants were also required by their district to establish daily learning targets for the students based on the standards. Learning targets describe the information, skills and reasoning processes that students will come to know as a result of the day's lesson (Moss & Brookhart, 2012). The idea was that teachers would be referring to the learning targets throughout the lesson so that students could guide their own learning. Each of the teachers interviewed stated that they were confident in their

ability to create learning targets but still need to work on the student involvement piece. Lisa shared the following:

> It is a school initiative to have learning targets for each lesson posted in the room. The kids have to know the target and are supposed to be able to track how well they are meeting the target. That is an area I still need to work on. Next year we are going to focus more on how students can monitor if they are meeting the targets. (Interview #4, March 26, 2014)

Lisa's comment implied that teachers are struggling to make formative assessment a consistent part of their daily instruction, especially when it comes to student investment in their own learning. The learning targets in these teachers' classrooms were intended to be aligned with the CCLS, linked to classroom formative assessment which includes feedback to students, and ultimately address the content and skills that will be assessed on the district common unit assessments. This district has made a commitment to the creation and use of common assessments. One of the benefits of common assessments is that teams can compare their results to the results of their colleagues (Bailey & Jakicic, 2012). Brenda shared her thoughts on the district common assessments:

> I like the common assessments in the aspect that everybody has the same goal. The common assessments help with collaborative data analysis because everyone is looking at the same thing. The hard part is having all the schools that are using the algebra common assessments able to provide input into the creation of the assessments, having a voice in the process does not always happen. We would get more out of the assessments from the conversations and the actual writing of the tests. (Interview #3, March 11, 2014)

Although Brenda recognized the value of the data received from the common assessments, she appeared to be frustrated with the process the district used to create them. The collaborative data analysis process has been more meaningful due to the fact that all teachers are giving a common unit assessment across the district, but the teachers felt they would benefit from being more involved in the writing of the assessments. Bailey and Jakicic (2012) noted that teams that engage in designing, using and responding to common assessments become more knowledgeable about their standards, more assessment literate and better able to develop strategies for helping all students learn. These teachers understanding of what their students should know and be able to do would be greatly increased if they were not only able to analyze the assessment results, but design the common assessments as well.

Four teachers from one of the school districts in the mid-west region of New York shared experiences with collaborative data analysis which resulted in four themes. The first theme dealt with what they believed to be the biggest challenges and greatest advantages to collaborative data analysis. All of the teachers noted that time is a challenge faced by many school based inquiry teams and they felt fortunate to have administration that provides structured time for them to work together. These teachers also valued the collective learning that takes place when teachers analyze data and share instructional best practices. The second theme recognized that trust was a key factor in the success of the collaborative data analysis process. The teachers all spoke of the need for a respectful and supportive environment where teachers can reflect on their pedagogy. Theme three identified that changes to instructional practice resulted from teacher collaboration. Teachers in this study were developing and implementing new strategies

based on the data analysis and their collegial conversations. Theme four addressed the need for common assessments aligned to the standards. The teachers believed the analysis of the common assessments was more meaningful since they were all looking at the same information and were focused on the same objectives.

Summary

This study primarily focused on teacher involvement in collaborative data analysis. The purpose of this study was to examine whether educators participation in collaborative data analysis protocols influenced teacher pedagogy as well as student achievement. This chapter presented the results of the study based on a statistical analysis of teachers' responses to the Data-Driven Instruction and Assessment Implementation Rubric and student performance data on the Algebra Regents exams. In addition, results from a typological analysis of four interviews were described.

Chapter 5 provides a discussion and interpretation of the findings in this study. Recommendations for future research, organizational procedures and professional development are also shared.

Chapter 5: Discussion

Introduction

Accountability requirements have put pressure on districts, schools and individual teachers to make sure students are considered not only proficient but also college and career ready. The New York State Reform Agenda is focused on students' attainment of college and career ready standards. To accomplish that goal, the reform agenda is comprised of three interrelated initiatives: common core learning standards and assessments, data-driven instruction, and teacher and leader effectiveness. Ingram et al. (2004) noted that if standards and accountability policies are to improve teaching and learning, schools must use data to determine if students are meeting the standards and utilize that information to adjust instructional practices when they do not. The problem remains that many educators lack the training and/or experience in using data to make informed instructional decisions. According to Bambrick-Santoyo (2010), effective data-driven instruction requires standards-based assessments, constructive analysis, action, and most importantly, a collaborative culture. For meaningful collaborative inquiry to occur, teams of educators must develop a high level of trust with one another and use data protocols to help make sense of the information. This research study was investigated through the lens of the social theory of learning referred to as "communities of practice." According to Wenger (2009) communities of practice involve active engagement of individuals who share the same passion for what they do and learn to do it better through ongoing interactions. In this study, mathematics teachers came together to

review the learning standards for algebra, create assessments, analyze data and reflect on their teaching using the communities of practice framework. The research problem of this study addresses building teachers' capacity to collaboratively analyze student performance data in order to improve instruction and increase student achievement.

The research paradigm of the study was a concurrent mixed-method design that allowed the researcher to gain a broader perspective of mathematics teachers' attitude toward and use of data-driven instruction. The purpose of this study was to examine the effect collaborative data analysis among educators has on both teacher practice and student achievement. The findings and recommendations of this study provide a lens for understanding the essential components of meaningful collaborative data analysis.

Chapter 5 presents a discussion and interpretation of the results of this study found in Chapter 4, in comparison to previous research on collaborative data-driven instruction. Chapter 5 is separated into four sections. The first section discusses implications of the findings from the implementation rubric, student performance data, and interviews with mathematics teachers. Limitations of the study will be discussed in the second section and recommendations will be identified in the third section. The final section provides a summary of the chapter.

Implications of Findings

Many factors must be in place for successful collaborative data analysis to occur. The results from this study provide several implications related to the implementation of each component of effective collaborative data analysis. The implications from the findings are divided into the following five areas: culture, assessment, analysis, action,

and student achievement. These areas directly align with the results from the implementation rubric, teacher interviews, and student performance data.

Culture. Love et al. (2008) state that a school culture characterized by trust and a collective responsibility for student learning is the foundation for collaborative inquiry, and in the absence of such a culture, schools might not be able to effectively utilize the data they have. This type of culture requires a change from a traditional emphasis on what the teacher supposedly taught to a focus on what students actually learned. The findings of this study indicate that for the culture component of the rubric there was significant improvement between the pre and post administration of the rubric. On average, the districts who participated in the communities of practice workshop improved their present state in terms of a data-driven culture to somewhere between beginning and proficient implementation. This finding is supported by the teacher interview data. The teacher interviews reveal the importance of active leadership, ongoing professional development, trusting relationships, sharing of strategies as well as visiting each other's classrooms, all of which are characteristics of the culture component of the rubric. These findings suggest that teachers recognize the need for collaborative data analysis to be an integral part of the work done in schools, but more work needs to happen before their schools are at an exemplary implementation status with respect to a data-driven culture. Research has found that in too many schools data analysis is viewed as an add-on, something separate from the daily life of the classroom (James-Ward, Fisher, Frey, & Lapp, 2013; Love et al., 2008). A school with a data-driven culture is one which data are used continuously, collaboratively, and effectively to improve teaching and learning.

Based on this study it appears that the school culture plays a vital role in the

success of collaborative data analysis. The establishment of a collaborative culture begins with school administration. The principal must carve out time for teachers to meet on a regular basis within the school day, provide professional development with respect to both collaboration skills and assessment literacy, as well as set clear expectations for collaborative data analysis. This study also revealed the importance of building trusting relationships among the teachers. For teachers to truly be open to transformative learning, they have to work in a supportive environment where they feel comfortable challenging the status quo. In a data-driven culture teachers use the data to make informed decisions about their practice.

Assessment. To purposefully inform their instruction, teachers must utilize multiple sources of data. Summative assessment data is the resource most often used by teachers. An essential reason for teachers to expend time, resources, and effort creating and administering assessments is that they inform teachers about the content and skill understanding of their students in order to inform subsequent teaching (Supovitz, 2012). The findings of this study indicate that for the assessment component of the rubric there was substantial improvement between the pre and post administration of the rubric. Bambrick-Santoyo (2010) stated that the standards are meaningless until you define how you will assess them. The average median score for the districts on the assessment component of the rubric was the highest of all the component scores with a score of 3.5. Teachers who participated in the workshop believed that at the end of the professional development they were between proficient and exemplary with respect to their implementation of common assessments aligned to the NYS Learning Standards. This finding suggests that as a result, due to the deep dive into the Algebra I Learning

Standards and the focus on both formative and summative assessment creation during the workshop, teachers recognize the value of common assessments in the collaborative data analysis process. The interview data coincides with the rubric findings in that the teachers acknowledge that common assessments allow teachers to analyze results together and establish common goals and lesson plans. Teachers appear to have more data rich conversations when the data is consistent and relevant to all involved in the dialogue. Examining data from the same standards-based assessment allows them to compare areas of strength and weakness. This level of analysis promotes questioning among teachers about the teaching strategies used in each other's classroom and is essential for teachers to make instructional adjustments. The findings from this study also indicate that teacher involvement in the development of the assessment benefits both the teachers and the students. From the teacher interview data, it seems as though the teachers were frustrated with the fact that they had inconsistent and minimal input into the unit assessments given to their students. Teachers tend to have a greater investment in educational resources when they are involved in the process. When teachers assist with the creation of an assessment, their understanding of the standards is expanded, which in turn assists them with writing daily lesson plans. In summary, this study found that the development and use of common assessments is an essential factor in collaborative data analysis and influences teachers' instructional practice and planning.

Analysis. The literature on effective data use strongly recommends the engagement of teams of educators in the collection, analysis and interpretation of data (Anderson et al., 2010). Putting teachers and administrators together with data does not ensure purposeful dialogue will occur. Teams must have a structured process for digging

deeper into the data. The findings of this study indicate that for the analysis component of the rubric there was improvement between the pre and post administration of the rubric. On average, the teachers in this study ranked their analysis of student data as "beginning implementation." These findings suggest that teachers have made growth in the area of data analysis, but are not completely confident in their abilities to organize and analyze student work at the level necessary to facilitate meaningful collaborative inquiry. This level of analysis requires readable charts and graphs that are easy to interpret and allows teachers to look at question-level, standard-level, individual student, as well as whole class data. Educators can quickly identify weakness and discuss strategies to address them with this type of data analysis. Based on the interview data where one of the teachers stated, "Charting out the error analysis takes time," teachers are most likely struggling to organize the data in an efficient way to be used for analysis. These findings suggest that organizing data can be time consuming and may be the reason some teachers avoid data analysis. Districts might want to consider investing in an assessment software package that can provide the teachers the data in a timely, systematic manner. Analysis of student work requires a quick turnaround of results in an organized fashion, structured time for collaboration, and solid procedures for examining the data. Data analysis assists teachers with identifying the student learning problem and examining root causes. According to Love et al. (2008), if data are going to provide the momentum for improvement, teachers need to make collective sense of the data, own the problems, and embrace the solutions together. Instructional improvements and increased student achievement result from the discussion and learning that takes place when investigating the problem. Based on this study, teachers seem to consider the opportunity

to discuss instructional best practices and learn new approaches to teaching as an advantage to collaborative data analysis. The findings from this study suggest that when educators are provided with time to collaborate, organized data and a structured process for analysis, reflective and informative dialogue occurs, which in turn enhances teacher pedagogy. The data analysis assists teams in setting the right goals for action.

Action. Setting goals, objectives and interventions are an important part of the instructional improvement process because they add accountability to the plan (James-Ward et al., 2013). A monitoring system must be in place to guarantee the action plan is implemented with efficacy and leads to the desired results for teachers and students. Data-driven instruction is worthless unless the information is actually utilized in the classroom (Bambrick-Santoyo, 2010). For the action component of the rubric the findings of this study indicate that there was no significant improvement between the pre and post administration of the rubric. On average, the teachers entered the workshop and concluded the workshop feeling that they were only at the beginning implementation level in terms of the action phase of data analysis. This finding suggests that teachers are not routinely completing the data analysis cycle and potentially need more professional development on action planning and progress monitoring. A low score in this component of the rubric implies that teachers might be stopping the process at the identification of the student learning problem, not developing new strategies, or at the very least, not assessing the effectiveness of a strategy that is being implemented. If an action plan calls for the continuation of the same instructional strategy it will be a waste of time, since more of the same will not produce different results. Based on the interview data, teachers

revealed that they are sharing and implementing new instructional strategies but they did not mention monitoring the effectiveness of those strategies.

Another important aspect of the action phase is engaging students in the assessment process. Students must know the end goal, where they are in relation to achieving the goal, and what actions they can take to improve. The teachers interviewed for this study acknowledge that student involvement in assessing progress with learning targets is an area they still need to work on. This finding suggests that the use of formative assessment and feedback is not the norm in many classrooms. Studies have shown that an intervention that includes strengthening the practice of formative assessment, which includes feedback, produces substantial learning gains (Black & Wiliam, 1998; Hattie, 2009; James-Ward et al., 2013). Formative assessment provides both teachers and students with feedback on the effectiveness of instruction and ultimately student learning. Based on the research and findings from this study, teachers appear to need more professional development on how to create and use both formative assessment and descriptive feedback on a regular basis, in order to be more successful with the action component of data-driven instruction.

Student achievement. The results from the analysis of student performance data from the NYS Regents exam in algebra shows there was no significant difference found between the districts that participated in the intervention and the ones used as the control group. This result could be related to the small number of times the teams attended the Communities of Practice: Algebra I workshop. Given more opportunities to meet as a team and participate in structured collaborative data analysis most likely would have produced a more pronounced effect on the student achievement on the June, 2014

Common Core Algebra I Regents exam. Another reason could have been that if the district teams did meet outside of the workshop, their collaborative-group time might not have been used as efficiently as needed to impact student achievement. Collaboration must be a systematic process whereby teachers work in teams to share knowledge with the goal of improving instructional practice to impact the academic achievement of all students (DuFour 2004b).

The first year of implementing the new Common Core Learning Standards in algebra most likely influenced the results as well. Outside of the Communities of Practice workshop, the researcher was unaware of any other professional development opportunities related to the standards in which the participating teachers might have been involved. . Teaching the common core aligned algebra course requires teachers to have a thorough understanding of the mathematical progression of the standards. The rigor of the standards also demands a change in pedagogy. The interview data indicates that the teachers were creating questions aligned with the common core standards and holding students responsible for problem solving and persevering through a task. This finding suggests that teachers are beginning to adjust their instruction to meet the demands of the common core, but based on the student performance data there is more work to be done. If used consistently and effectively, the collaborative data analysis process could be the vehicle to enhance teachers understanding of both the common core standards and the instructional approaches necessary to implement them successfully.

Limitations

The limitations of the study that may have impacted the results and findings are described in this section. First, the scope of the study was limited by the number of times

the teams actually met. Data-driven instruction is a cyclical process that requires ongoing reflective dialogue among educators. For effective collaborative data analysis to occur, teams need to meet consistently with a focus on student learning. Love et al. (2008) state that changing the school schedule to create time for teacher collaboration is a requirement for collective inquiry. Outside of the three workshop days, the researcher was unaware of whether or not the teams continued to meet regularly or even with the same attention to data protocols. Although the participants were actively involved during the professional development days, if they did not continue to engage in collective inquiry and apply the teaching strategies identified during the workshop back in their schools, it would be difficult to generalize that collaborative data analysis influenced their students' achievement. Additionally, the districts that did not attend the professional development might have had a designated time for their algebra teachers to meet for collaborative data analysis, of which the researcher was not aware.

The second limitation was that the assessment used to measure the students' achievement was aligned to the new Common Core Learning Standards and June, 2014 was the first administration of the Common Core Algebra I Regents exam. The curriculum for this course was much more rigorous than in the past and required teachers to make significant shifts in instruction. The teachers were insecure with their understanding of the standards and anxious about how their students would perform on the new exam. These factors could impact the teachers' ability to truly engage in the collaborative data analysis process and fully make the pedagogical changes necessitated by this new course. In addition, using the scale scores from a standardized test can be

abstract and less informative than an item analysis. Item mapping provides better information about what students can and cannot do (Barton & Coley, 2008).

Recommendations

The findings of this study and the review of literature lead to several recommendations for future research, organizational procedures and professional development.

Future research. Building on the results of this study, future quantitative studies might consider gathering formative and/or benchmark assessment data as well as the summative assessment data. Multiple sources of assessment data would provide the researcher with more evidence as to whether or not collaborative data analysis has a significant impact on student achievement.

Based on the results of this study, future mixed method studies might consider using multiple teams from several content areas in the same school over the course of a year. This would provide the researcher with additional opportunities to interact with teams and observe their data-driven dialogue throughout the school year, beyond the set days for professional development. This level of involvement would also allow the researcher to gather documents as evidence of data analysis and action plans. The findings from this study indicate that action planning was the weakest aspect of implementing data-driven instruction, so future research should focus on gathering more data with respect to that step in the data analysis process. Based on this study and a review of literature, school culture was found to have a direct impact on teachers' ability to engage in collaborative data analysis. By working with multiple teams from one school, the researcher would have a larger sample to collect data on how that school's

culture is impacting collaborative interactions among educators as well as teacher practice.

Organizational procedures. Based on this study and the body of research on Professional Learning Communities (PLCs), schools should be building time into the school day for teachers to collaborate. In addition to structured time to meet, districts must provide both teachers and administrators with professional development on creating standards-based common assessments, data analysis skills, and formative assessment so the time they spend together is purposeful, and focused on student learning. The key to successful data analysis is that it becomes ingrained in the way schools regularly conduct business (Flowers & Carpenter, 2009). Until schools move away from traditional practices, especially at the high school level, teachers will continue to primarily work in isolation and will most likely miss out on the benefits of learning from their colleagues.

Each year schools focus on multiple initiatives which can result in frustration among stakeholders. If schools just focused on implementing collaborative data analysis well, all three initiatives of the NYS Reform Agenda could be achieved. A critical component to successful collaborative data analysis is teachers having a thorough understanding of the standards and the ability to create assessments aligned to those standards which is what the first part of the reform agenda entails. The second component to powerful collaborative data analysis is utilizing data protocols and establishing actions that can be implemented and monitored. Data-driven instruction is the second aspect of the reform agenda. The third benefit to collaborative data analysis is the job embedded professional development that comes from teachers reflecting on their practice and sharing instructional strategies. The critical conversations had by educators

in these collaborative settings support teacher growth because they have the potential of touching upon all seven of the NYS teaching standards. In addition, the analysis of student performance data provides a lens into the effectiveness of the teacher's instruction. Teacher growth and effectiveness is the third initiative of the reform agenda. A commitment to structured collaborative inquiry by district administrators could have a huge impact on both teaching and learning.

Professional development. Throughout this research study it became abundantly clear that one of the most powerful teaching strategies is formative assessment. Black and Wiliam (1998) describe formative assessment as a learning experience that provides information that is actually used to adapt instruction to meet student needs. When done correctly, formative assessment produces significant gains in student achievement. The typical effect size of formative assessment studies are between $d = 0.4$ and $d = 0.7$ which are larger than most effect sizes found for educational interventions (Black & Wiliam, 1998; Hattie, 2009). "Cohen (1988), for example, suggested that $d = 0.2$ was small, $d = 0.5$ medium and $d = 0.8$ large when judging educational outcomes" (Hattie, 2009, p. 9). Based on this study and the research literature, it appears that teachers would benefit from professional development on what is meant by formative assessment, how to use it in the classroom, and most importantly how to get the students engaged in the process. High stakes summative testing tends to dominate teaching. Once teachers know how to effectively implement formative assessment in their instruction they can begin to utilize both formative and summative assessment information for collaborative data analysis.

Conclusion

The standards and accountability movement in education has put pressure on districts and schools as well as individual teachers to increase student performance in all areas. A major focus of the NYS Reform Agenda over the past four years has been the implementation of the Common Core Learning Standards. The standards are intended to provide consistency across districts and states so that all children are taught rigorous content and prepared for college or employment upon graduation. As teachers implement the Common Core Learning Standards, they are expected to use data gathered from classroom assessments in order to adjust and enrich future instruction to optimize student success. Collecting, organizing and analyzing data systematically does not automatically occur when teachers work together. Professional development that will equip teachers with knowledge and skills that will aid them in using student achievement data to improve instruction is essential. School districts must proactively foster the use of data to guide educational decision making and practice. Building a supportive culture for collaborative data analysis involves ensuring that teachers are knowledgeable about data protocols and comfortable having critical conversations. Research suggests that collaborative data analysis and effective classroom practices can make the difference for all students (Bernhardt, 2009; Reeves, 2000).

The purpose of this study was to examine ongoing collaborative data analysis among mathematics educators in the mid-west region of New York State and the potential impact it has on instructional practice as well as student achievement. The understanding of data-driven decision making and how it leads to improved teaching practices has been expanded by revealing more about how integrating formative and

summative assessments, collecting and analyzing data, and collaborating as teams works. A concurrent mixed-method research design assisted the researcher in achieving this purpose as well as providing new information to the P-12 education community. The use of a mixed methods design allowed the researcher to gain broader perspective on the study by making sense of the phenomena being studied from multiple data sources.

Over the course of this study, school teams participated in a three day workshop series that trained teachers and administrators in collaborative data analysis methods. The content of the workshop series was designed to support school districts in creating a positive culture of shared leadership and high-level data use. When educators have the time, training, and protocols for identifying areas for student growth, it opens up lines of communication and creates a community of learners (Levine & Marcus, 2007). This study revealed that a shared vision and positive relationships are essential components to building the trusting environment required for collaborative work. Establishing a culture of data use with explicit norms, expectations, and built-in collaboration time was also found to be critical. This study supported the research literature which noted that school leadership must provide a common meeting time built into the school day for teachers to collaboratively examine data. Teachers in this study acknowledged that collaborative data analysis most likely would not occur if their principal had not designated a specific time in the schedule for their team to meet. These findings suggest that when teachers are provided structured time within the school day meaningful collaborative data analysis, that leads to instructional adjustments, and targeted student interventions can be accomplished. When teachers see the value in data analysis they examine their instructional practices and find solutions to student learning problems. Based on this

study, teachers appreciate the collaborative data analysis process for the opportunity it provides to learn from colleagues. Teacher conversations about student achievement and instruction move beyond superficial discussion to a more reflective dialogue when using a process of inquiry. As noted previously in this study, collaborative data analysis is more efficient and effective when teachers give both formative and summative common assessments, especially when they have been involved in writing them.

The following conditions are essential for successful data-driven decision making: a professional culture; collaborative inquiry; multiple data sources, including common formative assessments to target ongoing instruction; root cause analysis; and strong leadership (Love, 2004; Bernhardt, 2009). Data-driven decision making has emerged as a prominent school improvement strategy, but according to this study and the research literature, there is still work to be done before schools are routinely using data to effectively inform instruction. Based on the findings of this study, the researcher concludes that the following priorities must be in place for collaborative data analysis to have an impact on both teacher practice and student achievement: access to timely, informative data; structured time for educators to collaborate that is focused on student learning; a trusting environment where teachers are open to new instructional ideas; and implementation and monitoring of action plans.

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Appendix A

Communities of Practice: Algebra I

Day One Agenda

- Introduction and Overview
  - Context/Background
  - Outcomes/Expectations
- Develop Norms
- Data-Driven Dialogue Protocol
  - Using Grade 8 Math data
- Task Deconstruction Protocol
  - Using sample grade 8 questions
- Standards of Mathematical Practices
- Formative Assessment
  - Create Assessments

Date: October 22, 2013
Time: 8am-3pm
Place of Meeting: ESC Conference Room 7

Facilitators:

Steve Montemarano, Math Instructional Specialist
Todd Smith, Math Instructional Specialist
Lorena Stabins, Staff Developer

Communities of Practice: Algebra I

Day Two Agenda

- Algebra I Regents Exam Overview
- Deep Dive into the Common Core Learning Standards for Algebra I
- Data-Driven Dialogue
    - Using Formative Assessment Data
- Possible Student Learning Problem
- Root Cause Analysis
- Instructional Strategies
- Action Plan
- Team Planning Time
- Reflection

Date: November 20, 2013
Time: 8am-3pm
Place of Meeting: 15 Linden Ave
Conference Rooms 1A and 1B

Facilitators:

Steve Montemarano, Math Instructional Specialist
Todd Smith, Math Instructional Specialist
Lorena Stabins, Staff Developer

Communities of Practice: Algebra I

Day Three Agenda

- Responses to Reflections
- Formative Assessment/Feedback
- Data-Driven Dialogue
    - Team Data
- Action Planning
- Team Work Time
- CCLS Summary
- Reflection

Date: February 11, 2014
Time: 8am-3pm
Place of Meeting: ESC Conference Room 7

Facilitators:

Steve Montemarano, Math Instructional Specialist
Todd Smith, Math Instructional Specialist
Lorena Stabins, Staff Developer

Appendix B

RUBRIC
DATA-DRIVEN INSTRUCTION & ASSESSMENT

Adapted from *Paul Bambrick-Santoyo & New Leaders for New Schools*

The rubric is intended to be used to assess the present state of data-driven instruction and assessment in a school. The rubric specifically targets interim assessments and the key drivers leading to increased student achievement.

4 = Exemplary Implementation 3 = Proficient Implementation 2 = Beginning Implementation 1 = No Implementation

DATA-DRIVEN CULTURE **1.** Highly active **Leadership Team:** foster teacher-leader data analysis meetings after each common/interim assessment and maintain focus on the process throughout the year **2.** **Introductory Professional Development**: teachers and leaders are effectively introduced to data-driven instruction—they understand how common/ interim assessments define rigor and experience the process of analyzing results and adapting instruction **3.** **Implementation Calendar:** Begin school year with a detailed calendar that includes time for assessment creation/adaptation, implementation, analysis, planning meetings, and re-teaching (**flexible** enough to accommodate district changes/mandates) **4.** **Ongoing Professional Development:** PD calendar is aligned with data-driven instructional plan: includes modeling assessment analysis/action planning and is flexible to adapt to student learning needs **5.** **Build by Borrowing:** Identify and implement best practices from high-achieving	__/4 __/4 __/4 __/4 __/4
ASSESSMENTS **1.** **Common/Interim** Assessments 4 or more times/year **2.** **Transparent Starting Point:** teachers see the assessments at the beginning of each cycle; they define the roadmap for teaching **3.** **Aligned to state standards and college readiness** **4.** **Aligned to instructional sequence** of clearly defined grade level/content expectations **5.** **Re-Assess** previously taught standards	__/4 __/4 __/4 __/4 __/4

ANALYSIS **1. Immediate** turnaround of assessment results (ideally 48hrs) **2. User-friendly, succinct** data reports include: **item-level** analysis, **standards-level** analysis & **bottom line** results **3. Teacher-owned** analysis facilitated by effective leadership preparation **4. Test-in-hand** analysis between teachers & instructional leaders	__/4 __/4 __/4 __/4 __/4
ACTION **1. Action Plan:** Identify instructional next steps based on data **2. Plan new lessons** collaboratively to develop new strategies based on data analysis **3. Ongoing assessment**: utilize in-the-moment checks for understanding and in-class assessment to ensure student progress between interim assessments **4. Accountability:** monitor implementation and effectiveness of action plan **5. Engaged Students** know the end goal, how they did, and what actions they are taking to improve	__/4 __/4 __/4 __/4 __/4

TOTAL: ___/80

Appendix C

Interview protocol

Time of Interview:

Date:

Interviewer:

Interviewee:

Introductions which include telling the interviewee the purpose of the interview, the use of a recorder and asking if the participant has any questions prior to the interview

Questions and follow up probes to have the individual elaborate on what was said, if necessary.

1. What do you see as the advantages to collaborative data analysis?

2. What do you see as the challenges to collaborative data analysis?

3. Instructionally, what have you done differently this year?

4. How has collaborative data analysis impacted your practice?

5. How are you assessing student progress this year? Is it different from previous years?

6. How have you involved the students in the assessment process? Provided feedback?

A final statement of appreciation to acknowledge the individual for their time and contributions to the study.