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The Relationship between Teachers' Instructional Practices, Professional Development, and Student Achievement

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The Relationship between Teachers' Instructional Practices, Professional Development, and Student Achievement

By

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Abstract

The Relationship between Teachers' Instructional Practices, Professional Development, and Student Achievement

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The power of an effective teacher has been recognized for years. The teacher in the classroom has the greatest influence on student learning and achievement. This basic premise has been forced to the forefront of educational debate because the measurement of student learning and achievement is tied to state, national, and international assessments and American students are not at the top. If students are not performing well, then teachers must be responsible.

The purpose of this study was to analyze how teacher instructional practices and teacher involvement in professional development are related to student achievement on the Nebraska State Accountability Mathematics Test (NeSA-M) during 2014. This study examined the variable of student achievement related to the variables of teacher practices in instruction and professional development.

There were statistically significant relationships between teacher instructional practices and student achievement on the NeSA-M. Five instructional practices were statistically significant when examining student achievement. The results showed only two indicators, expanding mathematics practice for enrichment on a computer and setting different goals for individual students, had a positive impact on student achievement. Three other instructional practices showed a negative impact of

NeSA-M test scores. The variable of professional development was analyzed for both topics and format. None of the professional development topics showed a statistically significant impact on student achievement on the NeSA-M test. Three of the indicators in professional development formats were statistically significant and only one of these, consulting with a subject specialist, had a positive relationship with student achievement.

This study suggests that a carefully aligned curriculum must be implemented with fidelity to expect teachers to have a positive impact on student achievement. This study further suggests that different instructional practices can help students to achieve in mathematics. This study suggests that professional development has the potential to positively impact student achievement, but close supervision of the implementation of newly learned skills may be necessary to receive the greatest benefit.

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Chapter 1

Introduction

The Responsibility for Learning

The teacher in the classroom has the greatest influence on student learning and achievement (Bill & Melinda Gates Foundation, "Learning about teaching," 2010; Commission on Effective Teachers & Teaching, 2011; Darling-Hammond, 2010; Ellett & Teddlie, 2003; Gallagher, 2004; Guskey, 2007; Kane, Taylor, Tyler & Wooten, 2011; Marzano, 2003; Ritter & Shuls, 2012; Rivkin, Hanushek & Kain, 2005; Stronge, Ward, & Grant, 2011; Weisberg, Sexton, Mulhern, & Keeling, 2009; Wright, Horn, & Sanders, 1997). This basic premise has been forced to the forefront of educational debate because the measurement of student learning and achievement is tied to state, national, and international assessments and American students are not near or at the top of the array of countries currently measured. If students are not performing well, then teachers must be responsible (Collins, 1992; Ding & Sherman, 2006; Faulkner & Cook, 2006; Marshall, 2012; Weisberg et al., 2009; Wright et al., 1997). The power of an effective teacher has been recognized for years. An early innovator in education recognized this power and was disappointed in many of her colleagues in the profession when they did not persevere to improve themselves in order to reach all students. In 1975, Marva Collins opened a school to help all students achieve at a high level, because of her disappointment in the education currently offered to students. The relationship between teaching and learning is at the core of many of the discussions in education today. Marva Collins' (1992) position on teaching and learning would fit today's discussion: "Don't try to fix the students, fix ourselves first. The good teacher makes the poor student good and the good student superior. When our students fail, we, as teachers, too, have failed."

Highly Qualified or Highly Effective?

As legislators propose to reauthorize the Elementary and Secondary Education Act (ESEA), one of the measures included is teacher qualifications (Klein, 2012; Editorial Projects in Education Research Center, 2011). In the 2001 version of ESEA, known as No Child Left Behind (NCLB), teachers must be highly qualified to teach. Highly qualified is defined as being certified to teach and proficient in subject matter. The proposed versions of the reauthorization change teacher qualification from highly qualified to highly effective. The definition of highly effective teaching requires teachers to be evaluated, at least in part, based on student growth in achievement (Klein, 2012).

The literature includes numerous of discussions about teacher effectiveness and the best way to evaluate it. Teacher quality is complex (Stronge et al., 2011). Experts are attempting to define effective teaching as observable teacher characteristics or practices (Danielson, 2007; Marzano, 2003; Rivkin et al., 2005; Schachter, 2012). These practices include the learning environment, instructional delivery, personal qualities and student assessment (Danielson, 2007; Stronge et al., 2011). Teaching can be labeled as both an art and a science (King & Watson, 2010; Marzano, 2003).

In the reauthorization drafts of ESEA, teacher evaluation models to measure effectiveness based on student achievement will be required (Klein, 2012). Many states have already undertaken the work of developing teacher evaluation models that include student achievement and growth as part of the waivers offered through the United States Department of Education for relief from NCLB penalties (Bill & Melinda Gates

Foundation, "Learning about teaching," 2010; Darling-Hammond, Amrein-Beardsley, Haertel & Rothstein, 2012; Garrett, 2011; Rice, 2012; Schachter, 2012). There is strong evidence between teachers' observed classroom practices and achievement gains (Jones & Johnston, 2004; Kane et al., 2011). With this strong link between teaching and learning, there is a missing connection between teacher evaluation and student achievement. Students are not achieving at the level they should to match teachers' evaluation ratings (Bill & Melinda Gates Foundation, "Learning about teaching," 2010). This information confirms the need to develop new teacher evaluation models. Teacher effectiveness matters for student achievement, so it should be identified, quantified, evaluated and replicated (Bill & Melinda Gates Foundation, "Learning about teaching," 2010; Darling-Hammond et al., 2012; DeWitt, 2011; Ellett & Teddlie, 2003; Garrett, 2011; Jones & Johnston, 2004; Kane et al., 2011; Weisberg et al., 2009).

Instructional Practices

Different experts emphasize different practices in effective teaching. Many begin with the knowledge of subject matter as core to the quality of a teacher (Schachter, 2012; Scot, Callahan, & Urquhart, 2009; Stronge et al., 2011). Many states require teachers to demonstrate knowledge via passing tests in their academic subject matter as well as showing general competency in reading, writing, and mathematics skills in order to receive teaching certification. The instructional process has been the core component of teacher evaluation systems, but the emphasis of these systems has been on superficial elements such as classroom organization, management, and presentation. The evaluations are based on a small number of observations, for a short time frame, and the evaluations are announced so the teacher and students are prepared for the event. The practices of effective teachers are gaining attention and being identified. The practices once identified should be able to be replicated to allow every student to benefit from experiencing these practices. The problem with the identification of these practices is that it is not a simple matter, lists of effective practices range from five to fifty (Danielson, 2007; King & Watson, 2010; Marzano, 2003). Using identified effective instructional practices does not guarantee a highly effective teacher. Teachers must be able to provide the product of effective teaching, demonstrable student learning. Student learning is measured through achievement on assessments.

Accountability

Educators are entering the second decade of the era of high standards and accountability. These high standards were created as a requirement to participate in federally funded educational programs. One of the measures in NCLB designed to drive broad gains in student achievement and to hold states more accountable for student progress is annual state testing (Editorial Projects in Education Research Center, 2011). By the 2005-06 school year, states were required to test students in grades 3-8 annually in reading and mathematics. By 2007-08, science was included as a state test and all of these tests had to be aligned to state academic standards. The purpose of these tests is comparative accountability. These state tests and other high-stakes mandated testing influence teachers in their work with students (Abrams, Pedulla, & Madaus, 2003; Barksdale-Ladd & Thomas, 2000; Faulkner & Cook, 2006; Hebert, 2007; Herman & Golan, 1993; Jones & Johnston, 2004; Louis, Febey & Schroeder, 2005; Valli & Buese, 2007, Wills & Sandholtz, 2009).

State tests are intended to measure student learning of the content included in the academic standards. Student performance on these tests defines student achievement and growth. Schools, districts, and states are compared and ranked based on the data generated from these tests. As teaching and learning are undeniably intertwined, the next step in this chain of accountability comes as teachers are held accountable for student achievement through the evaluation process. This is a shift in the focus of the education profession, from teacher-centered to learner-centered. Student learning is at the center of education and teachers are responsible for student learning (Bill & Melinda Gates Foundation, "Learning about teaching," 2010; Commission on Effective Teachers & Teaching, 2011; Ritter & Shuls, 2012; Wright et al., 1997). With responsibility, comes accountability therefore, teachers can expect to be held accountable for student learning (Commission on Effective Teachers & Teaching, 2011; Heim, 1996).

State testing and other high-stakes tests influence the instructional practices of teachers. The key areas of influence are content and pedagogy. As early as 1984, before the impact of NCLB and mandated state tests, research found that classroom practices were influenced by testing (Frederiksen, 1984). Teachers modify course content, instructional plans, and delivery based on the focus of tests students must take (Frederiksen, 1984; Herman & Golan, 1993). It is evident concerns about the influence of mandated testing on instructional practices is not a new one, nor has the early findings dissuaded policymakers from implementing more testing with more serious consequences for the purpose of accountability.

The primary objective of schools is student learning. To achieve this objective, schools must employ effective teachers and these teachers must use effective instructional methods to insure that all students are learning (Ritter & Shuls, 2012; Stronge et al., 2011). Nebraska is a typical state because it is involved in this same process of describing academic standards, assessing students on some of these standards, ranking and rating schools and districts based on the test results and now discussing a teacher evaluation model that includes student academic achievement. Nebraska has been slow to follow other states in the standards and assessment process. It gained recognition in 2001 for state assessment that was developed and conducted at the classroom level through its School-based Teacher-led Assessment and Reporting System (STARS). This was an internal approach to school accountability and school improvement (Roschewski, Gallagher, & Isernhagen, 2001). Through this process and the professional development that accompanied it, Nebraska's educators learned about quality assessment and integrated it into the daily practice of the classroom. STARS no longer exists in Nebraska, but the state's independence remains as it continues its reluctance to adopt the Common Core State Standards (CCSS) or a state-wide teacher evaluation model. Can Nebraska educators answer the challenge of Marva Collins to "fix ourselves?" Nebraska educators want their students to achieve, so can they take student achievement data and translate it into change in classroom instruction?

Purpose of the Study

The purpose of this study was to analyze how teacher instructional practices and teacher involvement in professional development are related to student achievement on the Nebraska State Accountability Mathematics Test (NeSA-M). This study examined the dependent variable of student achievement related to the independent variables of teacher practices in instruction and professional development.

Theoretical Framework

Two theories serve as foundation for the design of the independent variables in this study: equity theory in teaching and learning (Boaler, 2002) and contingency theory (Cohen, Lotan, & Leechor, 1989). These two theories provide a strong underpinning when considered and applied simultaneously for the equitable education of all students and the demonstration of their collective learning.

Equity Theory

According to Boaler (2202) with Equity Theory fairness occurs when rewards, punishments, and resources are allocated in proportion to one’s input or contributions. This equity theory has been applied to education in the expectation that there is a highly qualified teacher in each classroom and that all students are provided a sound education based on effective instructional practices and measured through performance on state assessments. The Equity Theory also applies well to school leadership. It is not unusual to find that teachers compare themselves to a referent other. Often teachers will select someone, who does more or less than themselves as the referent other, as they are paid on the same salary schedule. This theory can be important to a school leader because he/she should try to hold similar expectations for all teaching staff. Fairness is important in all workplace settings, but schools seem to be especially sensitive to issues of fairness. Leaders must hold the same high expectations for all staff members and offer all staff the opportunity to improve. In Equity Theory, fairness would be achieved, if all teachers are expected to give the same level of effort and achieve the same level of performance. In reality, individuals will choose to do more or less based on their own view of equity. The theory is best applied to the educational setting by the leader offering consistency and fairness to his/her staff members.

Contingency Theory

The relationship between the organization and environment and the productivity of a structure has been studied to determine which patterns are more effective in the Contingency Theory body of literature (Derr & Gabarro, 1972). The Contingency Theory can be used to describe a classroom as a collective while the scores on state tests are the measure of the productivity of the collective. The teacher is the supervisor of and the success of the class is dependent on the teacher's application of instructional strategies. The collective achievement is the product of the interrelationship of the supervision of the teacher and the production of the students. The supervision of the teacher is equated to the instructional practices applied by the teacher. The research study presented here is similar to the work of Cohen, Lotan, and Leechor (1989) who studied the classroom as a collective with standardized test scores aggregated as the aggregate productivity of the collective – classroom learning (Cohen et al., 1989). The extent of classroom learning is explained by variable properties of the collective, such as the instructional strategies utilized within the individual classrooms. Individual characteristics are not explained, nor are they used as explanations.

Problem Statement

Policy makers are committed to ranking each district, school and teacher. The measuring stick used is the results from mandated state tests in reading, mathematics, science, and writing. Once rankings are completed, those in the bottom half must improve or face serious consequences.

Teachers are responsible for the instruction of students and their acquiring of skills and knowledge. Student achievement is measured by performance on mandated state tests as a demonstration of skills and knowledge. Effective teachers positively impact the results on measures of student achievement. Will the student achievement results from mandated state tests cause teachers to change their instructional practices? Is there a relationship between the instructional practices used by a teacher and the achievement of the students in their classroom?

Teachers' effectiveness is rated based on student performance on achievement tests. As teachers are rated on effectiveness, the logical assumption is that they can improve their effectiveness by making changes in their classroom instruction. Research has shown mixed results of the influence of mandated state testing on the instructional practices of teachers. Studies show impact on the curriculum but the changes in pedagogy have not necessarily changed from less effective practices to more effective practices. Quality teaching is a complex concept which involves many facets teaching. Teachers reporting making changes in instruction did not always attribute the student achievement results on state tests as the catalyst for change.

School district leaders and building principals will benefit from a clearer alignment of effective teaching practices with student achievement results on state tests. This alignment may increase the value of state mandated student achievement test results if they can be used to shape teaching and learning in classrooms. How teachers respond to student achievement data may impact the quality of education for students.

Quantitative research on whether schools matter has focused on school and teacher characteristics and compared these to student social and economic characteristics.

This research does find significant effects for school characteristics, but the magnitudes of these effects tend to be modest, far overshadowed by the effects of student background characteristics (Wenglinsky, 2001). Quantitative research avoids studying the interaction between students and teachers because it is not easy to quantify teacher input to student achievement. Harold Wenglinsky, Educational Testing Service, attempted to fill this gap in the literature by using quantitative methods to study student academic achievement and teacher classroom practices, as well as, other aspects of teaching, such as professional development teachers receive in support of their classroom practices (Wenglinsky, 2001, p 2).

The purpose of this study was to examine the variable of student achievement as measured on the Nebraska State Accountability Mathematics Test (NeSA-M). This test is designed to measure proficiency on the Nebraska Mathematics Standards which describe what a student should know, understand, and be able to do at defined performance levels. This study examined the variable of student achievement as it relates to the variables of teachers' instructional practices and teachers' involvement with professional development.

Research Questions

By recognizing the connection between teachers and student achievement, this study attempted to respond to the broad question: what is the relationship between teachers' practices and student achievement? This question was addressed through two specific research questions:

Question #1: How are teachers' instructional practices related to student achievement on the NeSA-Mathematics Test?

Question #2: How are teachers' professional development experiences related to student achievement on the NeSA-Mathematics Test?

Data Analysis

Research Questions #1 and #2 was analyzed using the multilevel (hierarchical) linear modeling (MLM).

Definition of Terms

Nebraska State Accountability – Mathematics (NeSA-M). The State of Nebraska has mandated test of mathematics for all students in grades 3, 4, 5, 6, 7, 8, and 11. This test is considered a standardized test aligned with the Nebraska Standards of Mathematics. A 2010 Report of Alignment Analysis of Nebraska Content Standards and Indicators and the Nebraska State Accountability – Mathematics (NeSA-M) indicates a "strong alignment between the Nebraska Mathematics Content Grades 3 through 8 and 11 content standards, goals, and indicators and the NeSA-M assessment" (Nebraska Department of Education, 2010).

Nebraska State Accountability – Mathematics Average Scale Score. According to the Nebraska State Accountability (NeSA) Technical Report (2014), student raw scores on NeSA assessments may not represent the same skill level on every test form. Scale scores were assigned to each raw score point to adjust for slight shifts in item difficulties and permit valid comparison across all test administrations within a content area. Raw scores are converted to a standard 0-200 scale score. The value of 0 is reserved for students who are not tested or whose results are otherwise invalidated. No test scores are scored higher than 200 or lower than 1 even if this requires constraining the scale score conversion. Scale scores are the number reported to describe the performance of students, schools, and districts. The Average Scale Score is the mean scale score for the group of students identified in the same subject and grade.

Professional Development. Learning Forward, the professional learning organization for education, generally defines professional development as an approach to improve teacher effectiveness to raise student achievement (Learning Forward, 2001). In this study, professional development is defined as any opportunity to improve teachers' knowledge and skills in the area of mathematics and mathematics instruction.

Professional Development Participation Scores. The National Assessment of Educational Progress (NAEP) includes a teacher questionnaire to learn about teachers' participation in professional development. The teachers in this study completed the mathematics portion of this questionnaire. The questionnaire asks teachers to report their level of learning for different topics during the past two years of professional development. Teachers could respond "not at all", "small extent", "moderate extent", or "large extent". These responses were impressed on to a Likert scale of zero through three. Teachers also reported the format of the professional development by responding "yes" or "no", and these responses were translated into the numerical value of one for yes and zero for no (National Center for Education Statistics, 2014).

Professional Development Topics – Professional development opportunities include a wide-range of issues to improve teaching and learning. This study included the list offered on the NAEP Teacher Questionnaire in mathematics. The topics are outlined below using working definitions currently understood and applied by teachers in the field.

Professional Development – How Students Learn Mathematics. Teachers gain understanding of the foundational knowledge, including facts and concepts students need as well as how to help students organize their knowledge to facilitate retrieval and application (Donovan & Bransford, 2005).

Professional Development – Mathematics Theory or Application. Teachers gain understanding of the properties of numbers and how these apply to the mathematics students need to learn.

Professional Development – Content Standards. Professional development of content standards builds teachers' cognition of what students need to know and be able to do in mathematics at each grade level as aligned to state or national standards.

Professional Development – Curricular Materials. Professional development focused on curricular materials usually involves the review and evaluation of teacher and student content materials to determine how well materials are aligned to state or national content standards as well as the local curriculum. Materials are often reviewed for some level of quality presentation and teacher resources to support instruction.

Professional Development – Instructional Methods. Professional development concentrating on instructional methods may cover an extensive menu from any one of Robert Marzano's (2003) nine instructional strategies for effective teaching to specific application of math discourse techniques or using manipulatives, but all should focus on what teachers do to help students learn.

Professional Development – Effective Use of Calculators. This topic helps teachers to understand the pros and cons of calculator use in the classroom as well as when and how to effectively use calculators.

Professional Development – Use of Computers or Other Technology. Professional development focused on computers or other technology may take different paths. The most popular model for teachers is sharing websites or technology applications that are aligned with common topics and grade levels. Professional development may also focus on how to operate different technology tools. At the highest level, teachers learn to challenge students to solve problems and technology might be one of the tools students have available for the process.

Professional Development – Assessment Methods. Professional development in assessment methods might include a variety of subjects including formative assessment, summative assessment, writing quality assessment questions, project based learning, and even training to administer standardized tests correctly.

Professional Development – Test Preparation. Professional development in test preparation would include topics to assist students in test taking such as the best method to use when completing a multiple-choice or an essay style test, pacing or answer selection, and other issues like studying and dealing with test anxiety.

Professional Development – Ability Grouping. Professional development on ability grouping most often instructs teachers about how to organize their classroom for guided reading or math groups. This topic focuses on working with students of similar academic ability, how to organize the groups and how to instruct the same subject while adjusting to the different ability levels of the groups of students.

Professional Development – Teaching Strategies for Diversity. Professional development in teaching for diversity includes how teachers support the learning of all students, despite their many differences. This type of professional development may center on economic, cultural, racial, or gender differences, but often helps the teacher to understand how to build the appropriate classroom environment and interactions within the classroom.

Professional Development Format. Professional development has grown to include many different learning opportunities for teachers. This study included the list offered on the NAEP Teacher Questionnaire in mathematics. The formats are outlined below using working definitions currently understood and applied by teachers in the field.

Professional Development – College Courses. Teachers often increase their professional learning by attending college courses. Courses are now available online or on campus with many opportunities for very specific learning, ranging from how to implement a specific program to courses leading to advanced degrees.

Professional Development – Workshops. Workshops are typically short (30 minutes to one day) learning opportunities concerning very specific topics. Workshops often imply a higher level of interaction between the presenter and participants and frequently include activity-based learning for the teacher participants.

Professional Development – Conferences. Conferences are usually longer in length than workshops or seminars. Conferences usually are focused on a broader topic and last one or more days.

Professional Development – Classroom Observations. Teacher–to-teacher observation is a relatively new trend in professional development. Teachers observe a colleague as a means to learn about and share instructional strategies and ideologies and build a collegial environment for professional dialogue.

Professional Development – Mentoring & Peer Coaching. Mentoring is a form of professional development typically structured for new teachers. Mentoring is designed to build a supportive relationship between teachers, usually between an experienced and less experienced pair. Peer coaching is often designed to be task oriented and improve the skills of the teacher being coached.

Professional Development – Committee or Task Force Participation. Teachers may serve on school or district committees or task forces. This committee work usually includes study on the part of committee members to learn more about the topic of focus and allows teachers to serve as experts or leaders within the school or district concerning the subject.

Professional Development – Discussion or Study Group. Discussion or study groups may be formed by teachers or assigned by a school's administration to review a particular topic or area of concern or improvement. Discussion or study groups may be used to review student or school data and make plans to implement activities to improve student learning. This form of professional development may occur on a single day focused on a single topic or many include multiple meetings over a longer period of time.

Professional Development – Teacher Collaborative or Network. Teacher Collaboratives or Networks are structured organizations designed for teachers to work together with other teachers to learn or improve their teaching skills. This structure for professional development is not very common in Nebraska so it is often confused with mentoring or study groups because teachers interpret this as working with colleagues in a collaborative manner to share ideas on teaching.

Professional Development – Research. In research as professional development, a teacher selects a question or problem within his/her own classroom to study. A teacher gathers data to identify a topic or area of weakness either within his/her students' academic achievement or his/her own instructional practices, then study possible methods to change and improve the practice, apply the treatment, and follow up with additional data and analysis.

Professional Development – Independent Reading. Teachers read professional articles or books to learn more about a topic for personal growth. Study groups might participate in independent reading then discuss the material and determine how it might apply to their own classrooms.

Professional Development – Co-Teaching/Team Teaching. Co-teaching or Team Teaching is defined by Brody (1994): "It involves two or more teachers planning, teaching, and assessing the same students in the interest of creating a learning community and maintaining a commitment to collaboration with students and each other" (p. 32).

Professional Development – Consultation with Subject Specialist. Teachers meet with a math specialist to increase professional learning. The math specialist may be an employee of the school district or from an outside agency that supports the school district's professional development efforts.

Professional Development – District's Math Project. The study district has been involved in a multi-year professional development project for classroom teachers to improve their knowledge of mathematics and their instructional strategies. The project has been a partnership between two area school districts and the regional educational service agency for continuing professional development of elementary mathematics teachers.

Classroom Instructional Strategies. Instructional strategies include all approaches that a teacher may take to actively engage students in learning. These strategies drive a teacher's instruction as he/she works to meet specific learning objectives. Effective instructional strategies are designed to meet all learning styles and development needs of learners.

Classroom Instructional Strategies Scores. The National Assessment of Educational Progress (NAEP) includes a teacher questionnaire developed to help researchers learn about types of instructional strategies teachers use in their mathematics instruction. The teachers in this study completed the mathematics portion of this questionnaire. The questionnaire asks teachers to report the frequency of using the different strategies in their classroom. Teachers could respond “not at all”, “small extent”, “moderate extent”, or “large extent” for some questions and “never or hardly ever”, “a few times a year”, “once or twice a month”, “once or twice a week”, or “every day or almost every day.” These responses were impressed on to a Likert scale of zero through three or zero through four (National Center for Education Statistics, 2014).

Classroom Instructional Strategies – Differentiation. Differentiation is the practice of modifying instruction, assessment, or classroom management to accommodate a broad range of abilities within a classroom.

Classroom Instructional Strategies – Variety. Instructional variety is a description of the flexibility of an instructor when presenting a lesson. For a teacher, this means being able to shift from one form of instruction to another in order to maintain the focus of students.

Classroom Instructional Strategies – Goal Setting. Teachers set clear learning targets for students so that they understand what they are to learn and why. Students can also develop personal learning goals that map their progress toward these goals.

Assumptions

All teachers included in the study were offered the same professional development opportunities.

All teachers have the professional academic freedom to incorporate the identified instructional practices in their classroom teaching.

All students were provided instruction using the same mathematics instructional materials.

All students completed in the Nebraska State Accountability Mathematics Test (NeSA-M) under identical conditions.

All teachers accurately self-reported professional development participation and implementation of instructional practices.

Limitations

A small sample size may not translate to larger population.

The class average of NeSA-M scores may be impacted by the small *n* in each classroom and the variability of the mean due to extremely high or low student scores.

Students' class assignment is not truly random. The study's findings may not be able to differentiate teacher quality because of the students assigned to a particular teacher and reflected in the class average of NeSA-M scores.

Teachers self-define the meanings of the instruction practices and professional development topics and format. Teacher perceptions of these definitions may not match the working definitions of this study.

Teachers' self-reporting of implementation of instructional practices may not reflect the depth of implementation of each practice.

Delimitations

Individual teacher variables such as level of education, years of experience, and teacher certification were not considered.

Student variables were not considered in this study. Student demographics are similar across classrooms within the study district, but are not identical and were not considered. Student demographics include gender, ethnicity, socio-economic status, and special education qualifications.

Significance of the Study

This research study possesses the potential to contribute to future research, educational practice, and educational policy. It may be significant to all in education by adding to the body of quantitative research linking instructional practices and professional development to student achievement.

Contribution to Research. There are decades of research supporting the statement that the teacher in the classroom has the greatest influence on student learning and achievement. This study corroborated this body of literature but brought the work to the individual classroom and teacher level. This work supports more specific identification of instructional practices and professional development.

Contribution to Practice. Based on the outcomes of this research study, the district may revise professional development offerings for teachers. The topics and formats found to support student achievement may become standard training for all teachers. The district may decide to extend this research by including classroom observations to document the level of implementation of new training in instructional practices.

Contribution to Policy. Based on the outcomes of this research study, the district may decide to revise, alter, or enhance its current School Board of Education policy of teacher professional development. Administrative regulations and operational procedures regarding teacher professional development could certainly be impacted based on these results. Based on the outcomes of this research, the rubrics for teacher appraisal in the area of instructional practices could be revised.

Outline of the Study

The literature review relevant to this research is presented in Chapter 2. This section provides a comprehensive perspective about teaching and student achievement and the influence of large scale testing on classroom instruction. Chapter 3 describes the research methodology – its design and the procedures that were used to gather and analyze the data of the study. Chapter 4 reports the research results, and Chapter 5 provides conclusions and discussions of the research results.

Chapter 2

Review of Literature

Accountability: The Driver to School Improvement

Accountability is part of life for educators. In some places, accountability has been in place for three decades. The policy that moved accountability to the forefront of education was the No Child Left Behind (NCLB) act (U.S. Congress 2001). This act placed it on the pedestal as the answer to improving education for all students. The underlying principle for this policy is to hold high expectations for all students and their schools. The measurement tools are required state tests. These tests are followed by negative consequences (public exposure, mandated budgeting, and external takeover) which are supposed to motivate teachers and students, in low performing schools, to work harder and increase student achievement.

The common denominator in school improvement and student success *is* the teacher. Although various educational policy initiatives may offer promise of improving education, nothing is more fundamentally important to improving our schools than improving the teaching that occurs every day in every classroom. To make a difference in the quality of education, we must be able to provide ready and well-founded answers to the question: What do good teachers do that enhances student learning (Stronge et al., 2011)?

Teachers are the strongest influence on student achievement. Educational research is studying effective teaching, student learning, and the relationships between each of these.

Equity Theory – Effective Teachers

Equity means the simple sense of fairness in the distribution of the primary goods and services that characterize the social order (Edmonds, 1979). The Equity Theory began to be applied to education in the 1970's when Ronald Edmonds and other researchers reported that all children are eminently educable and that it is the behavior of the school that is critical to determining the quality of education for these children (Collins, 1992; Edmonds, 1979). Dramatically improving education means insuring that every student has an effective teacher, in every classroom, every year. Better information about teacher effectiveness could be an extraordinary valuable tool for achieving this goal (Bill & Melinda Gates Foundation, "Working with teachers," 2010).

A great proportion of the American people believe that family background and home environment are principal causes of the quality of student performance. Such a belief has had the effect of absolving educators of their professional responsibility to be instructionally effective. The major differences in performance between effective and ineffective schools cannot be attributed to differences in the race, social class, or family background of pupils enrolled in schools. The main factor attributed to major effects on student learning and achievement has been the teacher (Commission on Effective Teachers & Teaching, 2011; Darling-Hammond, 2010; Edmonds, 1979). Effective teachers take responsibility for both classroom and school-wide learning (Commission on Effective Teachers & Teaching, 2011). Boaler (2002) argues that equitable teaching means educators must pay attention to the particular practices of teaching and learning that are enacted in classrooms (p. 239).

A teacher's effectiveness has more impact on student learning than any other factor controlled by the school systems, including class size, school size, and the quality of after-school programs – or even which school a student is attending (Rivkin et al., 2005). Rivkin, et al. (2005) agree that teacher effectiveness has great impact, but warn that an analysis that studies the relationship between the level of achievement and school inputs is obviously susceptible to omitted variables or biases from a number of sources. There is concern that even in carefully constructed research studies it is extremely difficult to account for the variance in teacher quality. Rivkin, et al. (2005) explains that even if bias could be controlled by matching students with teachers and the analysis considered only within school variation in outcomes, both the intentional placement of students into classrooms and the need to account for the contribution of measurement error to the between-classroom variation would introduce serious impediments to the identification of the variance of teacher quality (p.425).

Confusion about teacher effects & effectiveness has led to some incorrect deductions. Misunderstanding of teacher effects (teacher pay, teacher degree, experience) and teaching effectiveness can lead to inappropriate conclusions that have a direct impact on professional development strategies, on teacher preparation program content, and on professional judgment (Ding & Sherman, 2006). Much of the quantitative research found little relationship between teacher effects and student achievement (Wenglinsky, 2001). Some of the literature suggests teacher effectiveness is influenced by student characteristics. Ding and Sherman's (2006) work suggested the role of students in their own learning must be recognized.

When teachers have the same curriculum, the same materials, and students from the same neighborhood, and classes are substantially equivalent, the key element to make a difference for students is the instruction – what a teacher and student are doing together. Instruction is a dynamic interaction of students' learning practices, teachers' teaching practices, and the content (Cohen & Ball, 2001). Differences in achievement among classrooms are typically explained as a product of the characteristics or behaviors of teachers (Cohen et al., 1989).

Creating equitable classrooms is imperative though no easy task. Cohen, Lotan, Scarloss, and Arellano (1999) found that it requires changing the organization of the classroom, the roles of teacher and student, and the nature of the curriculum. An equitable classroom requires deliberate classroom practices to produce equal-status relationships within the classroom. Failing this means some students will not have equal access to learning (Cohen, et al., 1999). Boaler (2002) illustrates in her work the effectiveness of teachers who are committed to equity. She concluded that the greatest hope for providing equitable teaching environments is to focus on teacher practices (p. 254).

All schools should be held responsible for effectively teaching all children. Equitable public schooling means all students will reach the same achievement level regardless of social economic status, ethnicity, parents, or school. To achieve this equitable schooling requires highly effective teachers (Commission on Effective Teachers & Teaching, 2011; Edmonds, 1979). In 2007, Barber completed an analysis of the top-performing school systems in the world. A key implication of the findings was the need for a relentless focus on ensuring high instructional quality while reducing variability in the quality of instruction for every student (Barber, 2007). All students deserve an effective teacher and to make this a reality will take evolutionary change in the profession.

Contingency Theory – School Organization

The relationship between organization and environment has been the focus of much research and theory construction. This growing body of literature has been called "contingency theory" since the common theme is that effective patterns of organizational structure and behavior are contingent on environment and task demands (Derr & Gabarro, 1972, p. 26). Cohen, et al. (1989) believe that through using organizational sociology, they have been able to develop and test conditionalized propositions that relate the type of differentiation in the technology (teaching practices), the nature of the teacher's supervision, and work arrangements among the students to gains in achievement at the classroom level. These propositions provide practical insights for classroom instruction and the results are sufficiently robust to conclude that this framework is a strong potential contributor to the improvement of classroom practice (Cohen et al., 1989). The greatest difficulty in using the concepts in the school systems setting is the problem of defining environment (Derr & Gabarro, 1972 p. 35). Cohen et al. (1989) offer that if one conceives of the classroom in organizational terms, one can use contingency theory to make predictions about learning outcomes at the classroom level. *Collective achievement* is the product of the interrelationship of the instructional technology, the type of supervision by the teacher, and the work arrangements among the students. In this application, the teacher is the supervisor of 30 workers (the students) laboring under crowded conditions. Test scores aggregated to the classroom level and predicted changes in the distributional properties of these test scores are measures of organizational effectiveness or productivity. Teaching methods and curriculum materials become the technology of the classroom, the organizational unit (Cohen et al., 1989, p. 76). A classroom can be analyzed as a *collective* which means the scores on standardized tests aggregated to the classroom level are the measures of the aggregated productivity of the collective – classroom learning (Cohen et al., 1989, p. 75). Difficulties may arise when using this model to explain organizational performance in school systems because of the difficulty of defining effectiveness (Derr & Gabarro, 1972).

Despite problems described in applying the concepts of this theory, it still offers promise for understanding school systems and how their organizations can be adapted to meet environmental demands (Derr & Gabarro, 1972, p. 39).

Effective Teachers

The key to improving the American education system is placing highly skilled and effective teachers in all classrooms (Darling-Hammond, 2010). Although there is growing consensus that effective teaching is the key to large-scale school reform, there is great debate among education stakeholders about how to identify and measure effective teaching (Bill & Melinda Gates Foundation, "Working with teachers," 2010). In fall 2009, the Bill and Melinda Gates Foundation launched the Measures of Effective Teaching (MET) project to test new approaches to measuring effective teaching. The goal of the MET project is to improve the quality of information about teaching effectiveness available to educational professionals (Bill & Melinda Gates Foundation, "Working with teachers," 2010).

Bryan Goodwin and a team of researchers at Mid-continent Research for Education and Learning (McREL) published in 2010 the compilation of decades of research to suggest three behaviors which distinguish highly effective teachers. 1) Highly effective teachers challenge their students. Good teachers not only have high expectations for all students, but they also challenge them, providing instruction that develops high-order thinking skills. 2) Highly effective teachers create positive classroom environments. One of the highest correlates of effective teaching is the strength of the relationships teachers develop with students. 3) Highly effective teachers are intentional about their teaching. They have clear learning targets and then have a broad repertoire of instructional strategies to use. They know what to teach, how to teach it, and when and why to do it (Goodwin, 2010, p. 8).

The act of teaching is a holistic endeavor. Effective teachers employ effective instructional strategies, classroom management techniques, and classroom curricular design in a fluent, seamless fashion (Marzano, 2003). They know their content and how to teach it to a broad range of students. They have an extensive range of instructional strategies and know when to use them. Effective teachers consider collaboration an essential element of their practice. Effective teaching is a student-centered practice which leads to improved student outcomes in clear and demonstrable ways (Commission on Effective Teachers & Teaching, 2011).

Gallup in their report *State of America's Schools* (2014) asserts that great teachers share some essential behavior patterns. These patterns include: 1) Achievement drive: great teachers are motivated to enable students to succeed and take it personally; 2) Classroom structure and planning: Balancing innovation and discipline are hallmarks of exceptional teachers. They are well-prepared and strive for new approaches to teaching, learning, and discovery; and 3) Strong student and parent relationships: These relationships are the foundation of successful learning environments. Great teachers make a commitment to understand and develop every student.

The knowledge and skills that teachers must master to be effective instructional leaders for all students in our nation's schools are complex and ever-changing. Teaching *is* like rocket science: complicated, collaborative, and capable of taking students to places yet to be explored (Commission on Effective Teachers & Teaching, 2011).

Effective Teaching and Achievement

By definition, teaching is effective when it enables student learning (Bill & Melinda Gates Foundation, 2013). It is clear that effective teachers have a profound influence on student achievement and ineffective teachers do not (Bill & Melinda Gates Foundation, 2013; DeWitt, 2011; Kane, Taylor, Tyler, & Wooten, 2010; Marzano, Pickering & Pollock, 2001). There is strong evidence concerning the relationship between teachers' observed classroom practices and student achievement gains (Kane et al., 2010). Teachers identified as more effective with one group of students, on average, caused other groups of students to learn more (Bill & Melinda Gates Foundation, 2013). Effective teaching requires understanding of what to do, how to do it, when to do it and why to do it (Goodwin, 2010).

Some critics and reformers believe good teaching is something that can be quantified, replicated and packaged. They, also, believe that given the right textbooks or high-stakes exam, educators can be made to teach in the same way which will result in equality in the classroom. This equality will, ultimately, mean that all students will succeed (DeWitt, 2011). John Hattie (2009) reviewed hundreds of meta-analyses on teaching effects and concluded that "it is teachers using particular teaching methods, teachers with high expectations for all students, and teachers who have created positive student-teacher relationships that are more likely to have the above average effects on student achievement" (p. 126).

NCLB has emphasized the importance of highly qualified teachers in every classroom. There are questions as to the difference between highly qualified and highly effective teachers. Highly qualified teachers need to be assessed as highly effective teachers based on student achievement data (Darling-Hammond, 2010). An important question is whether or not there are significant differences between schools and teachers in their abilities to raise achievement and how important are any differences in teacher quality in the determination of student outcomes (Rivkin, et al., 2005).

Stronge, Ward, and Grant (2011) did a cross-case analysis on the impact of teachers on student achievement gain scores, but found few empirical studies had addressed the matter of what high-performing versus low-performing teachers do differently. In one study, Stronge, et al. (2008) not only examined the measureable impact that teachers have on student learning but also further explored the practices of effective versus less effective teachers. Although the studies that examine the value-added impact that teachers have on student learning explore the practices of effective teachers differently, one common finding emerges: Teachers have a measureable impact on student learning. Although, Stronge, et al. (2011) did not find significant differences between effective and ineffective teachers concerning the dimensions of instructional delivery and assessment, they did not suggest that these are unimportant. They did find a difference of more than 30 percentile points could be attributed to the quality of teaching occurring in the classrooms during one academic year.

An Educational Testing Service (ETS) study sought to fill the gap in the literature for quantitative research studying the link between student academic achievement and teacher classroom practices. Although large-scale quantitative research studied those teacher characteristics that are easily measurable, such characteristics, such as years of experience or level of educational attainment, tend to be far removed from what actually occurs in the classroom. To study teacher classroom practices and the kinds of training and support pertinent to these practices that teachers receive, it is necessary to draw primarily on the findings of qualitative research (Wenglinsky, 2001).

Qualitative research suggests classroom practices can produce improvements in the academic performance of all students, regardless of their backgrounds (Wenglinsky, 2001). McREL research identified nine categories of instructional strategies that have a high probability of enhancing student learning: Identifying similarities and differences, summarizing and note taking, reinforcing effort and providing recognition, homework and practice, nonlinguistic representations, cooperative learning, setting objectives and providing feedback, generating and testing hypotheses, and questions, cues, and advance organizers (Marzano et al., 2001). The relatively consistent results from studies are encouraging but little can be said about which specific classroom practices employed by teachers are most important in promoting achievement (Kane et al., 2010). There are challenges in estimating relationships between specific classroom practices and student achievement gains because of the nonrandom assignment of students and teachers to each other and the nonrandom assignment of observed classroom practices across teachers (Kane et al., 2010).

Wenglinsky (2001) did a quantitative study of classroom practices and student achievement. His first hypothesis is that teacher quality includes three aspects: the teacher's classroom practices, the professional development the teacher receives in support of these practices, and the characteristics of the teacher external to the classroom, such as educational attainment. He maintains that of these three, classroom practices will have the greatest impact on student academic performance, professional development the next greatest, and teacher characteristics the least. His results confirmed that teachers' classroom practices had the greatest effect on student achievement and he also found that professional development topics had a significant effect (Wenglinsky, 2001).

There are few alternatives to test-based measures that could provide reliable and valid information on the effectiveness of a teacher's classroom practice. Despite decades of evidence that teachers differ in their impacts on youth, efforts at evaluating teacher effectiveness through direct observation of teachers in the act of teaching remains a largely perfunctory exercise (Kane et al., 2010).

Influence of Testing on Teaching

High stakes tests are a contextual condition that can have serious impact on the learning and development of both children and their teachers (White, Sturtevant, & Dunlap, 2003). There are conflicting statements about the impact of accountability policies in which some argue that testing undermines good teaching, while others claim that it stimulates improvement (Louis et al., 2005).

Student learning is an important indicator of the quality of teaching. Charlotte Danielson has concerns about the use of the results of student testing to make high-stakes decisions about teachers. There is danger of narrowing the curriculum and that instruction becomes focused on identifying the correct answer rather than understanding complex content (Abrams et al., 2003; DeWitt, 2011). The pressure to raise test scores and improve student performance may make teachers feel required to devote substantial instructional time to test preparation (Abrams et al., 2003).

Abrams, et al. (2003) studied teachers' perceptions of state testing programs. These perceptions were organized around four main topics: (a) impact on classroom practices in terms of content of instruction and the strategies used to deliver instruction, (b) the pressure to prepare students for the state test, (c) impact on teacher and student motivation and morale, and (d) views of accountability. Curriculum standards established by states are intended to articulate high expectations for academic achievement and clear outcomes for students. The majority of teachers feel positively about the content of the standards, yet a substantial number of teachers believe the state testing program leads them to teach in ways that contradict their own notion of sound educational practice.

Many preservice and beginning teachers found contradictions between what they learned in their university studies and actual instruction in the public school settings. These study participants indicated the state tests influenced instruction. State-mandated tests promote an emphasis on a more skills-based view of curriculum and more teacher-centered approach to teaching than had existed in either the university methods courses or the collaborating schools' programs of study (White et al., 2003).

It is important to be aware of the possible influence of state-mandated testing on the quality of teaching especially when test scores are the measure of student achievement and effective teaching.

Professional Development of Teachers

Effective teaching requires preparation for an increasingly complex profession. Professional development for teachers is recognized as a vital component of policies to enhance teaching and learning. Effective teachers must reassess their practice and learn new approaches (Commission on Effective Teachers & Teaching, 2011; Gulamhussein, 2013; Ingvarson, Meiers, & Beavis, 2005).

The relationship between quality teaching, effective professional learning, and improved student achievement seems clear enough to make each part a priority for schools. Daily in schools, teachers use the same materials, to teach the same curriculum, covering the same standards, yet students are not making the same gains. The major difference when comparing classrooms in the same school is the teacher and his or her instructional practices. If a student shows a consistent area of weakness, educators design and implement an intervention. Intervention is an aim at improvement, therefore an intervention in instruction requires a change from current practice. This requires learning new knowledge, skills, and/or practices, relearning something forgotten or mobilizing the will to use this learning. If a teacher is struggling to get students to achieve, it may be time for an intervention in instruction. An intervention aims at improvement, therefore a change in the current situation, so the intervention for instruction is professional development (Cohen & Ball, 2001).

The standards for professional learning outline the characteristics of professional learning that increase educator effectiveness and results for all students. Learning Forward describes the relationship between professional learning and student results as a four step cycle. When professional learning is standards-based, it has a greater potential to change what educators know and are able to do and believe, which leads to changes in educator practice. With improvements in teacher practice, students have a greater likelihood of achieving results (Learning Forward, 2001).

Three core features of professional development activities have shown significant, positive effects on teachers' self-reported increases in knowledge and skills and changes in the classroom: a) focus on content knowledge; b) opportunities for active learning; and c) coherence with other learning activities (Garet, Porter, Desimone, Birman, & Yoon, 2001). Teachers want high-quality professional learning that is meaningfully connected to their daily work and to the students they serve. Professional development should be informed by teacher self-assessments and evaluations. High-quality professional development focuses on improved student learning, is peer-reviewed, is job-embedded, and is differentiated by career stage, expertise, and other criteria (Commission on Effective Teachers & Teaching, 2011).

A recent study revealed that certain topics for professional development may be more effective than others in raising student achievement (Telese, 2012). Helping teachers make a fundamental shift in practice requires very powerful approaches to professional development. The process of reflective inquiry through the action research cycle is one such approach (Gningue, Schroeder, & Peach, 2014). There are several different types of professional development recommended as examples of high quality enhancement for teachers. One study found that examining teaching practice and developing curriculum were most predictive of implementing standards-based instruction. In this study, there appeared to be only a weak relationship between types of professional development and student achievement on state exams (Huffman, Thomas, & Lawrenz, 2003). In another study, the subject area showing the greatest student growth matched the area of greatest professional development both in number of hours as well as depth of training in understanding assessments (Gallagher, 2004).

The structure of the professional development is known to affect teacher learning. The most common type of structure for professional development is a workshop format where teachers sit and listen to learn new content and skills. This has been shown to have little to no impact on the ultimate goal of professional development: improving student learning (Garet et al., 2001). Teachers report that workshops often have no influence on their classroom practices because the workshop information was not useful to them (Gulamhussein, 2013). Another research study examined the impact of online professional development courses on fifth grade teachers' pedagogical content knowledge and practices and students' mathematics achievement. The results showed significant gains in teacher overall pedagogical content knowledge and pedagogical practices. This confirms other research that intensive, sustained, and content-focused professional development can effect positive change in teacher practice (Marzano & Toth, 2013).

Developing teacher effectiveness is as important as measuring it. Teachers' participation in performance assessments can help teachers improve their practice. Experiencing a process like National Board Certification can result in teachers improving their subject matter knowledge, design, and delivery of instruction, classroom management, and evaluation of and support for student learning. A performance assessment requires teacher candidates to synthesize all of the many things they are supposed to be learning – how to diagnose student learning, plan with a focus on standards, manage and revise instruction, and evaluate outcomes for student understanding (Darling-Hammond, 2010).

A growing body of research indicates that improving teachers improves student performance. Professional development affects student achievement via three steps. First, professional development enhances teacher knowledge and skills. Second, better knowledge and skills improve classroom teaching. Third, improved teaching raises student achievement. If one link is weak or missing, better student learning cannot be expected (Ingvarson et al., 2005; Marzano & Toth, 2013; Yoon, Duncan, Lee, Scarloss, & Shapley, 2007).

Significant attention has been focused on teacher professional development due to a process-product conceptualization of causality. This straight-forward equation links effective professional learning activities as ones which improve teacher instructional practices and therefore increase student learning. The connection seems intuitive, but demonstrating it is difficult. Showing that professional development translates into gains in student achievement poses important challenges, despite an intuitive and logical connection. To substantiate the empirical link between professional development and student achievement, studies should ideally establish two points. One point is the links between professional development, teacher learning and practice, and student learning.

The other is that the empirical evidence must be of high quality (Opfer & Pedder, 2011; Yoon et al., 2007).

Thomas Guskey (2014) is emphatic that professional learning must be planned with the end goal in mind. If the primary goal of professional learning is to improve student learning outcomes, planning must begin by clarifying those outcomes. The accountability movement has placed increased pressure on schools and districts to provide targeted professional development that will clearly improve student achievement (Huffman et al., 2003). As teacher expertise increases, it is highly likely that schools and districts will see a corresponding increase in student learning gains over time (Marzano & Toth, 2013). One meta-analysis found that teachers who receive substantial professional development – an average of 49 hours in 9 studies – can boost their students' achievement by approximately 21 percentile points (Yoon et al., 2007).

A great deal of the research into teacher professional development is based on self-reported learning and participation. This method of data gathering has resulted in mixed results in the body of literature. One study found that the number of hours of professional development has little or no effect on the ability of teachers to improve student achievement on the Florida state tests. It was also noted that professional development takes time away from classroom instruction and preparation time. In addition, if substitute teachers are hired so that professional development can take place during school hours, and if substitutes are less effective or unable to maintain the continuity of instruction, then this may reduce the measured teacher value-added results (Harris & Sass, 2010). The results of another study showed that middle school students performed better on the National Assessment of Educational Progress (NAEP) when their teachers received less professional development. In this same study, teachers who think of themselves as highly qualified may have participated in less professional development and had higher student achievement than those teachers who participated in more professional development (Telese, 2012).

While professional development is often touted as the key to education reform, it appears that professional development for individual teachers is not always enough (Huffman et al., 2003). Positive changes in teacher pedagogical content knowledge and practices did not translate into any meaningful differences for student achievement in studies. True effects of professional development on student achievement cannot be ascertained without first considering teachers' opportunity to implement their learning (Marzano & Toth, 2013). Much work remains to be completed to fully understand the ways in which professional development affects the ability of teachers to promote student learning. These findings provide mixed results for the benefits of professional development.

Teacher Evaluation - Purpose

The core purpose of teacher evaluation is not to assess past performance, but to inform professional development to maximize teacher growth and effectiveness. Teachers should be evaluated based on their ability to fulfill their core responsibility as professionals – delivering instruction that helps students learn and succeed. These evaluations will advise staffing decisions moving forward (Bill & Melinda Gates Foundation, "Working with teachers," 2010; Weisberg et al., 2009).

The primary goal of teacher evaluation research has been to identify characteristics of exemplary teaching and learning environments, which should then enhance student learning and subsequent achievement (Ellett & Teddlie, 2003). Evaluation systems fail to differentiate performance among teachers, as a result, teacher effectiveness is largely ignored (Weisberg et al., 2009). Every day, effective teachers are treated the same as ineffective teachers when using teacher evaluation systems. As it is known there are significant differences in teacher effects on children, all teachers are effectively mis-categorized when all are evaluated in the same manner (Bill & Melinda Gates Foundation, 2010, p. 30).

Two major research studies form the foundation of change in teacher evaluation policies and practices. First, The New Teacher Project (TNTP) was founded by teachers in 1997 to close the achievement gap by ensuring equity in teaching for all students. The project incorporated four states, twelve school districts and approximately 15,000 teachers. TNTP learned teacher evaluation systems fail to recognize the variations in the effectiveness of teachers. The failure of evaluation systems to provide accurate and credible information about individual teachers' instructional performance sustains and reinforces a phenomenon called the Widget Effect. The Widget Effect describes the tendency of school districts to assume classroom effectiveness is the same from teacher to teacher. This decades-old fallacy fosters an environment in which teachers cease to be understood as individual professionals, but rather as interchangeable parts. In its denial of individual strengths and weaknesses, it is deeply disrespectful to teachers; in its indifference to instructional effectiveness, it gambles with the lives of students (Weisberg et al., 2009).

The second study called the Measures of Effective Teaching (MET) was initiated by the Bill and Melinda Gates Foundation in 2009. The goal of the MET project was to improve the quality of information about teaching effectiveness available. The ultimate hope was that this information would help to build fair and reliable systems for teacher observation and evaluation and to improve student achievement through the opportunity to experience effective teaching.

Evaluating teachers in the United States is certainly not a new activity. It is as old as the education system in the country. The system has experienced many trends and cycles as roles of teachers have changed, as values and beliefs about effective teaching and teacher responsibilities have changed, as perceptions of how students best learn have changed, and as societal demographics and teaching contexts have changed. Over the past thirty years, a variety of new conceptual and methodological developments in teacher evaluation, teacher effectiveness, school improvement and school effectiveness has emerged. One significant development in teacher evaluation is the changing focus of classroom-based evaluation systems from teaching to learning (Ellett & Teddlie, 2003).

Practitioners, researchers, and policy makers agree that most current teacher evaluation systems do little to help teachers improve or support personnel decision making (Darling-Hammond et al., 2012). More importantly, these systems are not providing the information needed to close the achievement gap (Bill & Melinda Gates Foundation, "Working with teachers," 2010). Variables often used to determine entry into the teaching profession and salaries, including post-graduate schooling, experience, and licensing examination scores, appear to explain little of the variation in teacher quality (Hanushek & Rivkin, 2010). Kane et al., (2011) assert little has changed in the way that teachers are evaluated, in the content of pre-service training, or in the types of professional development offered.

While there is considerable evidence that the quality of teaching does influence school effectiveness, there is a need for a new generation of teacher evaluation systems that focus on the connectedness between teaching and learning (Ellett & Teddlie, 2003). Kane et al., (2011) contend that there are discernable differences in mastery of specific skills within the 90% of teachers receiving a “Satisfactory” rating on evaluations, and those differences in skills predict differences in student achievement. Most would agree that there is not one best way to teach to enhance student learning and achievement, and most would probably also agree that there are core elements of teaching and learning environments that are logically and empirically linked to student outcomes (Ellett & Teddlie, 2003). As schools attempt to educate students to achieve new, more challenging academic standards, improvements in teacher evaluation could play a critical role in identifying areas in which teachers need to improve their skills (Gallagher, 2004).

Teacher effectiveness, teacher evaluation, and school and classroom effectiveness seem inextricably interrelated over time (Ellett & Teddlie, 2003; Gallagher, 2004). There’s a growing consensus that evidence of teacher contributions to student learning should be part of teacher evaluations systems, along with evidence of quality teaching practices (Darling-Hammond et al., 2012). To determine the effects of high-quality teaching, a valid and reliable method of identifying and measuring quality instruction is necessary (Gallagher, 2004; Kane et al., 2011). Teachers around the country are ready to embrace accountability if it is coupled with decision-making (Commission on Effective Teachers & Teaching, 2011). Many in education believe it is essential to attach “stakes” to performance evaluation outcomes for teachers and school administrators. Basing these critical decisions on accurate measures of teacher effectiveness will help create cultures of excellence in schools, where the focus is on achieving individual, group, and school performance goals related to student achievement (Weisberg et al., 2009).

It has been argued that traditional approaches to teacher evaluation have done little to improve schools in the United States. It is believed that a new learner-centered assessment and evaluation procedures are needed that embrace the larger literatures related to teacher learning and professional development, student learning, school improvement, and school effectiveness (Ellett & Teddlie, 2003). Schools, districts, and states will know and be able to measure the impact teachers are having on student performance by adopting a teacher evaluation model built on deliberate practice and continuous growth (Marzano & Toth, 2013).

Teacher Evaluation – Process

There are aspects of effective teaching, supported by research, incorporated into professional standards for teaching that offer some useful approaches to teacher evaluation. For a variety of measures of effective teaching to be used in evaluation, they must be based on aspects of teaching that excellent teachers recognize as characteristic of their practice; if the measures are unrecognizable to thoughtful practitioners, they will not be adopted. Similarly, for measures of effective teaching to be effective, they must pinpoint aspects of teaching that improve student learning; if the measures are unrelated to student learning, they will have no impact (Barber, 2007). Teaching is too complex for any single measure of performance to capture it accurately. A teacher's effectiveness – the most important factor for schools in improving student achievement requires multiple measures (Bill & Melinda Gates Foundation, 2013; Weisberg et al., 2009).

Standards-based teacher evaluation systems have the potential to provide measurements of teacher practice that would be more strongly related to student learning. Each measure adds something of value to the evaluation. A balanced approach is most sensible when assigning weights to form a composite measure. Balanced weights indicate multiple aspects of effective teaching. Multiple measures produce more consistent ratings than student achievement measures alone. Estimates of teacher effectiveness are more stable when a combination of classroom observations, student surveys, and measures of student achievement are used (Bill & Melinda Gates Foundation, 2013; Milanowski, 2004).

Early results of the MET project, as well as other studies, indicate a new direction for teacher evaluation and development practices. Teacher effectiveness must be determined through evidence-based processes that are fair, accurate and transparent. An equally weighted composite score of student achievement, classroom observations, and student surveys done in a more meaningful manner, has done a better job of predicting teachers' success than years of experience and advanced degrees (Bill & Melinda Gates Foundation, "Working with teachers," 2010; Bill & Melinda Gates Foundation, 2013; Commission on Effective Teachers & Teaching, 2011). Teacher evaluation systems built on performance assessments that measure what teachers actually do in the classroom, and which have been found to correlate with student achievement, are a much more effective tool for evaluating teachers' competence. A carefully crafted teacher evaluation system has the advantage of furnishing teachers and administrators with details about specific practices that contribute to each teacher's effectiveness as well as supporting needed changes in teacher development. These systems should include evidence of student work and learning as well as evidence of teacher practices (Darling-Hammond, 2010; Darling-Hammond et al., 2012; Kane et al., 2011; Marzano & Toth, 2013).

There is considerable argument concerning the logic behind and the extent to which students' achievement data should be used as a basis for teacher evaluation. The MET project data suggest that assigning 33% to 50% of the weight for the state test results maintains considerable predictive power, increases reliability, and potentially avoids the unintended negative consequences from assigning too-heavy weights to a single measure (Bill & Melinda Gates Foundation, 2013). Other studies warn value-added measures, which determine a teacher's unique contribution to each student's performance offer comparisons among teachers, but they cannot help teachers understand why one teacher is more successful than another, nor do they suggest what a teacher would have to change to improve his/her effectiveness in the classroom. Teacher evaluation processes should include, as a major component, a reliable and valid measure of a teacher's effect on student academic growth over time. The use of student achievement data from an appropriately drawn standardized testing program, administered longitudinally and appropriately analyzed, can fulfill this requirement. If the ultimate goal is to improve academic growth of student populations, one must conclude that improvement of student learning begins with the improvement of relatively ineffective teachers (Bill & Melinda Gates Foundation, "Working with teachers," 2010; Bill & Melinda Gates Foundation, 2013; Wright et al., 1997).

Evaluations based on well-executed classroom observations do identify effective teachers and teaching practices (Kane et al., 2011). For observations to be of value, they must reliably reflect what teachers do throughout the year (Bill & Melinda Gates

Foundation, 2013). Reliability of observation scores increases when including the perspectives of two or more observers, using observers from both within and outside the school, and increasing the number of observations, even for just part of a lesson (Bill & Melinda Gates Foundation, 2013). Evaluators must be well trained in implementing rigorous, but achievable performance standards, objectively measuring teacher performance against those standards, providing constructive and actionable feedback to teachers and designing and providing differentiated support teachers need to meet or exceed the standards (Weisberg et al., 2009). Classroom observations can be powerful tools for professional growth. The descriptions of practices and different performance levels for each practice that comprise the rubrics in the teacher evaluation system can help teachers and administrators map areas of growth and professional development plans (Bill & Melinda Gates Foundation, 2013; Kane et al., 2011).

Implementing specific procedures in evaluation systems can increase trust in the data and the results. These include rigorous training and certification of observers, observing multiple lessons by different observers, and when using student surveys, assuring student confidentiality. Student perception surveys and classroom observations can provide meaningful feedback to teachers (Bill & Melinda Gates Foundation, 2013). Students seem to know effective teaching when they experience it (Bill & Melinda Gates Foundation, "Working with teachers," 2010). A well-designed student perception survey can provide reliable feedback on aspects of teaching practice that are predictive of student learning (Bill & Melinda Gates Foundation, 2013).

By adopting a teacher evaluation system with a clear focus on effective instructional practice, schools, districts, and states will know precisely how their teachers are performing. They will know and be able to measure the impact teachers are having on student performance. Schools will have the data needed to ensure continuous growth for both teachers and students (Darling-Hammond, 2010; Marzano & Toth, 2013; Weisberg et al., 2009).

Teacher Evaluation – Student Achievement

The literature suggests teacher evaluation scores may be useful as representations of teaching practices that affect student learning. The empirical results show that evaluations produced by a rigorous, standards-based system are related to an accepted measure of student learning (Darling-Hammond et al., 2012; Kane et al., 2011; Milanowski, 2004). The content area with the teacher evaluation system most closely aligned to the state standards had the greatest student growth (Bill & Melinda Gates Foundation, "Working with teachers," 2010; Gallagher, 2004; Milanowski, 2004). The analytical framework used to attribute differences in classroom achievement to teachers has many problems, but there is strong evidence concerning the relationship between teachers' observed classroom practices and the achievement gains made by their students. This may enhance teacher evaluation systems (Hanushek & Rivkin, 2010; Kane et al., 2011).

Another sector of the literature suggests caution as the relationship between teacher evaluation, teacher instructional practices and student achievement is not easy to measure. In one study, Darling-Hammond, et al. (2012) reported that gains in student achievement are influenced by much more than any individual teacher. Other factors include: school factors; home & school supports; individual student needs and abilities; health and attendance; peer culture; prior teachers; summer learning loss; and specific tests used. It appears that "teacher effectiveness" is not a stable enough construct to be uniquely identified even under ideal conditions. The notion that there is a stable "teacher effect" that's a function of the teacher's teaching ability or effectiveness is called into question if the specific class or grade-level assignment is a stronger predictor of the value-added rating than the teacher (Darling-Hammond et al., 2012). Test-based measures by themselves offer little guidance for redesigning teacher training or targeting professional development; they allow one to identify particularly effective teachers, but not to determine the specific practices responsible for their success (Kane et al., 2011).

Teachers said they couldn't identify a relationship between their instructional practices and their value-added (statistical methods to measure changes in student scores) ratings, which appear unpredictable (Darling-Hammond et al., 2012). There is a danger that a reliance on test-based measures will lead teachers to focus narrowly on test-taking skills at the cost of more valuable academic content, especially if administrators do not provide them with clear and proven ways to improve their practice (Kane et al., 2011). Researchers warn that it takes at least three years of data about a given teacher to achieve a modicum of stability using student test score data (Darling-Hammond, 2010). There is substantial variation in teacher quality as measured by the value added to achievement or future academic attainment or earnings (Hanushek & Rivkin, 2010). The challenge is to combine measures in ways that support effective teaching while avoiding such unintended consequences as too narrow a focus on one aspect of effective teaching (Bill & Melinda Gates Foundation, 2013).

Traditional teacher quality variables appeared to be insignificant predictors of variation in student achievement, especially when compared to more proximal indicators of instruction (Gallagher, 2004). The data gleaned from the observations allow researchers to connect specific teaching practices with student achievement outcomes, providing evidence of effective teaching practices that can be widely shared (Gallagher, 2004; Kane et al., 2011). Research clearly identifies teacher skills as one of the most, if not the most, important factors in driving student achievement. Problems with most existing approaches to evaluation are that they do not adequately address teacher growth in skills (Marzano & Toth, 2013).

A growing body of research indicates that by improving teachers student performance can be improved (Marzano & Toth, 2013). Seemingly, more can be done to improve education by improving the effectiveness of teachers than by any other single factor (Wright et al., 1997). Even if one is solely interested in raising student achievement, effectiveness measures based on classroom practice provide critical information to teachers and administrators about what actions can be taken to achieve the goal (Kane et al., 2011). As teacher skill improves, students show a corresponding percentile gain (Marzano & Toth, 2013). The content area where teachers had a generally high sense of efficacy in instruction was the area with higher classroom effect scores (Gallagher, 2004). Teachers with high value-added scores on state tests tend to promote deeper conceptual understanding. The types of teaching that lead to gains on state tests correspond with better performance on cognitively challenging tasks and tasks that require deeper conceptual understanding (Bill & Melinda Gates Foundation, “Working with teachers,” 2010).

Effective teaching can be measured. Groups of teachers who are more effective helping students achieve can be identified. Effective teachers help students learn regardless of outside factors or classroom organization and across grades, subjects, and years (Bill & Melinda Gates Foundation, “Working with teachers,” 2010; Bill & Melinda Gates Foundation, 2013; Gallagher, 2004; Wright et al., 1997).

Chapter 3

Methodology

Overview

The primary objective for schools is student learning. To achieve this objective, schools must employ effective teachers and these teachers must use effective instructional methods to insure that all students are learning (Ritter & Shuls, 2012; Stronge et al., 2011). The teacher in the classroom has the greatest influence on student learning and achievement (Bill & Melinda Gates Foundation, "Learning about teaching," 2010; Commission on Effective Teachers & Teaching, 2011; Darling-Hammond, 2010; Ellett & Teddlie, 2003; Gallagher, 2004; Guskey, 2007; Kane et al., 2011; Marzano, 2003; Ritter & Shuls, 2012; Rivkin et al., 2005; Stronge et al., 2011; Weisberg et al., 2009; Wright et al., 1997). This basic premise has been forced to the forefront of educational debate because the measurement of student learning and achievement is tied to state, national, and international assessments and American students are not near or at the top of the array of countries currently measured. If students are not performing well, then many people point to teachers as the reason why (Collins, 1992; Ding & Sherman, 2006; Faulkner & Cook, 2006; Marshall, 2012; Weisberg et al., 2009; Wright et al., 1997).

The purpose of this study was to analyze how teacher instructional practices and teacher involvement in professional development are related to student achievement on the Nebraska State Accountability Mathematics Test (NeSA-M). This study examined the dependent variable of student achievement related to the independent variables of teacher practices in instruction and professional development. A quantitative approach was utilized to discover a relationship between teachers' classroom instructional practices and student achievement. This approach was, also, applied to identify any relationship between teachers' professional development activities and student achievement.

Hypotheses

According to the nature and extent of the problem identified and stated previously, the null Hypotheses (H_0) for this study is:

"There is no statistically significant impact on student achievement based on some teacher practices such as classroom instructional practices and professional development", which was tested against the alternative hypothesis (H_1): "There is a statistically significant impact on student achievement based on some teacher practices such as classroom instructional practices and professional development."

In order to test the hypothesis properly, there were two specific null hypotheses in this study. Each of them examined specific indicators of quality teacher practices (independent variable) related to the student achievement (dependent variable). They are:

a. There is no significant difference in the class performance average in NeSA-Math based on teachers' instructional practices.
b. There is no significant difference in the class performance average in NeSA-Math based on teachers' professional development experiences.

Kane, et al. (2010) attempted to identify effective classroom practices by examining student achievement data. In this study, classroom observations of teacher practices using the teacher evaluation were correlated with student achievement scores on the state test. They found students gained two or more percentile points on the state math test if they were in a classroom with a teacher who incorporated the "best practices" as identified on the evaluation model. Wenglinsky (2001) studied the link of teacher classroom practices with student performance based on the National Assessment of Educational Progress (NAEP) test. He matched teacher responses to the NAEP Teacher Questionnaire about professional development and also classroom practices. His findings show that classroom practices and professional development will have greater effect on student achievement than other aspects of teacher quality.

Subjects

Teachers assigned to grades three, four, five, or six in a suburban school district in eastern Nebraska were included in this study. Teachers in these grades have the earliest experience instructing students who must participate in the Nebraska State Accountability (NeSA) testing. This school district annually compiles student achievement data by classroom groups and tracks student results by teacher assignment. The school district's student population is very homogeneous and has little diversity based on socio-economic status, ethnicity, English Language Learners, or special education qualification. The district's student population qualifying for free and reduced priced lunch is 10.6% as compared to the Nebraska average of 44.9%. The district's ethnicity is 89% White as compared to the state average of 68.9%. The state average for English Language Learners is just above 6% while the district average is 0.3%. The percentage of students qualifying for special education in the district is 9.7% while the state average is 15.7%.

Data Collection Procedures

Student data from the Nebraska State Accountability Tests in mathematics was analyzed for a suburban school district in eastern Nebraska. All study data for math achievement are retrospective, archival, and routinely collected school information.

Permission from the appropriate school personnel was obtained. Data was reviewed from the 2014 administrations of the NeSA-Mathematics test. All students in grades three through six were included and sorted by mathematics teachers. The data was available for twenty-nine teachers and NeSA-M scale scores was available and matched to teachers for 577 students. All student and teacher data was masked in study documents to protect the identity of individual students and teachers. All teachers within the study were asked to complete a survey about professional development and classroom instructional practices. Teacher surveys are used by the district to gather information annually each spring. Teacher surveys were coded to link them to their class averages. Responses were categorized as to the impact on student achievement and an analysis of instructional practices was completed and matched to achievement.

Performance Site

The research was conducted in the public school setting through normal educational practices. The study procedures did not interfere with the normal educational practices of the public school and did not involve coercion or discomfort of any kind. Data was stored on spreadsheets and computer flash drives for statistical analysis in the office of the primary researcher and the dissertation chair. Data and computer files were kept in locked file cabinets. No individual identifiers were attached to the data.

Instruments

Nebraska State Accountability-Mathematics (NeSA-M) 2014

The Nebraska State Accountability-Mathematics (NeSA-M) Test is the single statewide assessment of the Nebraska academic content standards in mathematics in Nebraska’s K-12 public schools. (Nebraska Department of Education, 2014) The assessment in mathematics is administered in grades 3-8 and 11. The NeSA-M operational test includes operational and field test items. This test is administered online via the test engine developed and managed by Digital Recognition Corporation (DRC), the INSIGHT Online Learning Management System. Depending on grade, the test form includes 50 to 60 operational items.

The goal for the operational forms is to meet a mean *p*-value of approximately 0.65 with values restricted to the range of 0.3 to 0.9 and point-biserial correlations greater than 0.25, based on the previous field test results. Some compromises are allowed when necessary to best meet the objective of the assessment to conform to the test specifications and to operate within the limitations of the item bank (Nebraska Department of Education, 2014, p. 20).

Reliability

The ability to measure consistently is a necessary prerequisite for making appropriate interpretations (i.e., showing evidence of valid use of results). Conceptually, reliability can be referred to as the consistency of the results between two measures of the same thing. This consistency can be seen in the degree of agreement between two measures on two occasions. Operationally, such comparisons are the essence of the mathematically defined reliability indices (Nebraska Department of Education, 2014, p. 64).

The reliability index used for the 2014 administration of the NeSA-M was the Coefficient Alpha α. Acceptable α values generally range from the mid to high 0.80s to low 0.90s. The total test Coefficient Alpha reliabilities of the whole population for the NeSA-M ranged from 0.91 to 0.94. Reliability estimates for subgroups based on gender, ethnicity, special education status, English Language Learner status, and food program eligibility status were also computed and show fairly high reliability indices for all subpopulations from 0.87 to 0.96 across the grade levels in mathematics. These α values indicates that the NeSA-M is not only reliable for the population as a whole, but it is also reliable for subpopulations. Overall, these two sets of α values provide evidence of acceptable reliability (Nebraska Department of Education, 2014, p. 64).

Validity

Content validity addresses whether the test adequately samples the relevant material it purports to cover. The NeSA-M for grades 3 through 11 is a criterion-referenced assessment. The criteria referenced are the Nebraska mathematics content standards. Each assessment was based on and was directly aligned to the Nebraska statewide content standards to ensure acceptable content validity.

For criterion-referenced, standards-based assessment, the strong content validity evidence is derived directly from the test construction process. The item development and test construction process ensures every item aligns directly to one of the content standards. This alignment is foremost in the minds of the item writers and editors. Review committees check the alignment of the items with the standards and make adjustments as necessary. The result is consensus among the content specialists and teachers that the assessment does in fact assess what was intended (Nebraska Department of Education, 2014, p. 70).

The NeSA-M has also been checked for validity based on the internal structure of the assessment. Item-test correlations have been measured using the Pearson's product-moment correlation coefficient between test items. In the 2014 NeSA-M Tests, no items had a negative point-biserial correlation and most items were above 0.30, indicating good item discrimination (Nebraska Department of Education, 2014, p. 37).

The NeSA-M includes four strands of mathematics: number sense; geometry and measurement; algebraic; and data analysis and probability. Correlations between strand scores provide information on the internal structure of the test. For each grade, Pearson's correlation coefficients between the strands within the content area were calculated. The intercorrelations between the strands in math are positive and generally range from moderate to high in value giving support to the evidence of internal-structure validity (Nebraska Department of Education, 2014, p. 71).

Teacher Questionnaire

The teacher survey is adapted from the 2011 Grade 4 National Assessment of Educational Progress (NAEP) Teacher Questionnaire. A copy of the modified Teacher Questionnaire is included in Appendix A. The Background Information Framework, developed by the National Assessment Governing Board in 2003, guides the collection and reporting of non-cognitive assessment information. The National Assessment Governing Board sets policy for NAEP and is responsible for developing the framework and test specifications that serve as the blueprint for the assessments and questionnaire. Questions considered for inclusion in the questionnaire are reviewed by experts and are tested with teachers before the actual administration. When developing the questionnaires, NAEP ensures that the questions do not infringe on respondents' privacy, that they are grounded in educational research, and that the answers can provide information relevant to the subject being assessed (National Center for Education Statistics, 2014).

Teachers are asked to complete a questionnaire about their instructional practices, classroom organization, and training. While teachers' completion of the questionnaire is voluntary, the study district encourages their participation since their responses provide a greater understanding of student experiences as they prepare for major assessments like the NeSA-M. Teacher responses are also valuable to the district as a planning tool for professional development.

The teacher questionnaire is organized into different parts. The first part of the questionnaire includes background and general training and items concerning years of teaching experience, course work in specific subject areas, amount of in-service training and professional development, and the extent of control over instructional issues.

Subsequent parts of the questionnaire include classroom organizational and instructional information, availability of resources for the classroom, and teacher exposure to issues related to the subject and the teaching of the subject. Also included are questions concerning pre- and in-service training, the ability level of students in the class, the length of homework assignments, the use of particular resources, and how students are assigned to particular classes.

Independent and Dependent Variables

In this study, the independent variables included classroom instructional practices and professional development activities. In order to organize the collection data process and its statistical analysis, each variable was disaggregated into specific variable-indicators. These variables were defined as categorical data and analyzed as potential predictors of student achievement. The detailed indicators were gathered from the

Teacher Questionnaire and grouped in the independent variables of instructional practice and professional development (see Figure 1).

Figure 1. Independent Variable Indicators

No.	Teacher Practice	Variables and Indicators
1	Instructional Practice	Practice or review mathematics topics on the computer Extend mathematics learning with enrichment activities on the computer Research a mathematics topic using a computer Use a drawing computer application for geometry Play mathematics computer games Set different achievement standards for some students Supplement the regular course curriculum with additional material for some students Have some students engage in different classroom activities Use a different set of methods in teaching some students Pace my teaching differently for some students Discuss the student's current level of performance Set goals for specific progress the student would like to make Discuss progress the student has made toward the goals previously set Determine how to adjust your teaching strategies to meet the student's current learning needs and to reflect the student's future goals

2	Professional Development Topic	How students learn mathematics Mathematics theory or applications Content standards in mathematics Curricular materials available in mathematics Instructional methods for teaching mathematics Effective use of manipulatives in mathematics instruction Effective use of calculators in mathematics instruction Use of computers or other technology in mathematics instruction Methods for assessing students in mathematics Preparation of students for district and state assessments Issues related to ability grouping in mathematics Strategies for teaching mathematics to students from diverse backgrounds (including English Language Learners)

3	Professional Development Format	College course taken since your certification Workshop or training session Conference or professional association meeting Observational visit to another school or classroom Mentoring or peer observation and coaching as part of a formal arrangement Committee or task force focusing on curriculum, instruction, or student assessment Regularly scheduled discussion group or study group Teacher collaborative or network, such as one organized by an outside agency or over the Internet Individual or collaborative research Independent reading on a regular basis – for example, educational journals, books, or the Internet Co-teaching/team teaching Consultation with a subject specialist Collaborative Math Project

Student achievement was defined as the dependent variable. Since mathematics is a core subject in elementary education curriculum, standardized test results were identified as reliable parameters to reflect student achievement. In this case, class performance average on the NeSA-Mathematics test was selected as the student achievement indicator because it should be a more clear representation of what a student has learned from a specific teacher. This data was defined as continuous variables and it was analyzed as the variable being predicted.

Variables and their Measurement

To guide the data collection and data analysis processes, a complete study's alignment describing specific procedures for each study variable was described in the following paragraphs.

The instructional practices variable was tested to answer the question: How are teachers' instructional practices related to the student achievement on the NeSA-Mathematics Test? It was addressed by taking into account the following instructional practices as independent variables: practice or review mathematics topics on the computer, extend mathematics learning with enrichment activities on the computer, research a mathematics topic using a computer, use a drawing computer application for geometry, play mathematics computer games, set different achievement standards for some students, supplement the regular course curriculum with additional material for some students, have some students engage in different classroom activities, use a different set of methods in teaching some students, pace my teaching differently for some students, discuss the student's current level of performance, set goals for specific progress the student would like to make, discuss progress the student has made toward the goals previously set, determine how to adjust your teaching strategies to meet the student's current learning needs and to reflect the student's future goals as categorical variables.

In order to measure the effects of the independent variable of instructional practices on the dependent variable, student achievement, the Multilevel Linear Modeling (MLM) tests were performed. The data for each of the independent variables required coding teacher responses into numerical codes to allow for analysis (see Figure 2).

Figure 2. Instructional Practices Measurement			
Variable	Data Type	Codes/Score Range	Survey Question
Instructional Practices – Technology	Categorical	0=Never or hardly ever 1=Once or twice a month 2=Once or twice a week 3=Every day or almost every day	12
Instructional Practices – Differentiation	Categorical	0=Not at all 1=Small extent 2=Moderate extent 3=Large extent	13
Instructional Practices – Goal Setting	Categorical	0=Never or hardly ever 1=A few times a year 2=Once or twice a month 3=Once or twice a week 4=Every day or almost every day	14

The construct professional development was tested to answer the question: How are teachers' professional development experiences related to the student achievement on the NeSA-Mathematics Test? It was addressed by taking into account the following professional development as independent variables: how students learn mathematics, mathematics theory or applications; content standards in mathematics; curricular materials available in mathematics; instructional methods for teaching mathematics; effective use of manipulatives in mathematics instruction; effective use of calculators in mathematics instruction; use of computers or other technology in mathematics instruction; methods for assessing students in mathematics; preparation of students for district and state assessments; issues related to ability grouping in mathematics; and strategies for teaching mathematics to students from diverse backgrounds (including English Language Learners). The format of professional development activities included: college course taken since certification; workshop or training session; conference or professional association meeting; observational visit to another school or classroom; mentoring or peer observation and coaching as part of a formal arrangement; committee or task force focusing on curriculum, instruction or student assessment; regularly scheduled discussion group or study group; teacher collaborative or network; individual or collaborative research; independent reading on a regular basis; co-teaching/team teaching; consultation with a subject specialist; and Collaborative Math Project.

In order to measure the effects of the independent variable of professional development with the dependent variable, student achievement, the MLM tests were performed. The data for each of the independent variables required coding teacher responses into numerical codes to allow for analysis (see Figure 3).

Figure 3. Professional Development Measurement

Variable	Data Type	Codes/Score Range	Survey Question
Professional Development - Topics	Categorical	0=Not at all 1=Small extent 2=Moderate extent 3=Large extent	4
Professional Development - Formats	Categorical	0=No 1=Yes	5

Student achievement, expressed as the class performance average on the NeSA-Mathematics test was defined as continuous variables. As dependent variables, they were tested along with each independent variable (instructional practices and professional development). The NeSA-Mathematics student scores have been converted from raw scores to scales scores (see Figure 4).

Figure 4. Class Performance Average on NeSA-Mathematics Test Measurement

Variable	Data Type	Score Range	Source
Class performance average on NeSA-Mathematics Test	Continuous	0 – 200	Nebraska Department of Education

Data Analysis

Data collected from teachers and students were matched by using codes, which were based on grade and teacher number. Both teacher survey responses and student performance on the NeSA-Mathematics test were entered into statistical software to convert individual data into statistical information.

The initial step of this study matched data collected from teachers and students. Teacher survey responses about instructional practices and professional development participation were translated into numerical values as shown in Figures 2 and 3.

The Multilevel Linear Modeling (MLM) data analysis process was conducted in a sequence of steps. The first step was an intercept-only model, in which there are no predictors and the test was for mean differences between teachers. The second was a model in which the first level predictor, either instructional practices or professional development, was added to the intercepts-only model (Tabachnick & Fidell, 2013).

The purpose of this research study was to examine the variable of student achievement on the NeSA-M Test as it relates to the variables of teachers' instructional practices and teachers' involvement with professional development. Evaluation of the data was completed prior to the MLM. The first evaluation was an intraclass correlation. This is the ratio of variance between groups at the second level of the hierarchy to variance within those groups (Tabachnick & Fidell, 2013). An intraclass correlation is a numerical value that measures the amount of variability in the dependent variable that can be explained by the teacher groups. The second evaluation of the data was a check for multicollinearity within each independent variable. This process checks for variance inflation due to items too closely related to provide unique information.

The Multilevel Linear Modeling was able to identify the percent of variance associated with differences between teachers. The MLM was also able to identify significant predictors in the second-level variables influencing student performance on the NeSA-Mathematics test.

Chapter 4

Results

Purpose of the Study

The purpose of this study was to test the core null hypothesis: “There is no statistically significant impact on student achievement based on some teacher practices such as classroom instructional practices and professional development.” It was addressed through two specific hypotheses: 1) there is no significant difference in the class performance average in NeSA-Math based on teachers’ instructional practices; and 2) there is no significant difference in the class performance average in NeSA-Math based on teachers’ professional development experiences. This chapter presents the statistics analysis outputs.

Hypothesized Model

A two-level hierarchical model assessed the effects of classroom instructional practices and professional development on class performance average on the NeSA-Math test. It was expected that class performance would be positively related to teachers’ instructional practices and professional development experiences.

First-level units were teachers’ classrooms, in which student scores on the NeSA-Mathematics test were nested, resulting in 577 student scores for analysis. Table 1 show the mean for the NeSA-Mathematics test for each teacher’s classroom. Second-level units were the twenty-nine teachers who participated in the survey. Multilevel modeling was implemented through SAS PROC MIXED, Version 9.3.

Hierarchical models are those in which data collected at different levels of analysis (e.g., teachers’ classrooms and practices) may be studied without violating assumptions of independence in linear multiple regression. For example, the fact that students were identically tested and have the same exposure within the classroom means that scores from students within each classroom are not independent of each other. Multilevel modeling takes account of these dependencies by estimating variance associated with group (e.g., classrooms) differences in average scores (intercepts) and group differences in associations (slopes) between predictors and the dependent variable (e.g., classroom differences in the relationship between instructional practices and student achievement). This is accomplished by declaring intercepts and/or slopes to be random effects.

In the hypothesized model, students and teachers' classrooms are declared random effects to assess variability among students within teachers' classrooms as well as variability among classrooms. Multicollinearity was evaluated through a multiple regression run through IBM SPSS REGRESSION for each of the variables and its indicators. It was determined that the variable of Instructional Practices – Differentiation had two indicators highly correlated which might cause variance inflation, therefore one of the indicators was removed for the analysis. In the variable Instructional Practices – Goal Setting, the indicators were highly correlated therefore two were removed from the final analysis. The factor analysis was completed for the Professional Development variables and indicators. There appeared to be a high correlation between two of the indicators under Professional Development – Topics, thus one indicator was removed. The researcher determined that no indicators would be removed from the analysis of Professional Development - Format.

The intraclass correlation is the ratio of variance between groups at the second level of the hierarchy (teachers' classroom). About 8% of the variability in the student achievement scores is associated with the differences in teachers.

Research Question #1

How are teachers' instructional practices related to student achievement on the NeSA-Mathematics Test? Frequencies of responses and descriptive statistics for Instructional Practices in the area of Technology can be found in Tables 2 and 3. Frequencies of responses and descriptive statistics for Instructional Practices in the area of Differentiation can be found in Tables 4 and 5. Frequencies of responses and descriptive statistics for Instructional Practices in the area of Goal Setting can be found in Tables 6 and 7.

Table 8 shows that there are differences in the intercept and the fixed effects of the instructional practices. The intercept is the average of all of the separate teachers' classrooms and the estimate is the classroom average of the scale score on the dependent variable of NeSA-Mathematics test. The estimate for each indicator within the independent variable represents the change from the intercept estimate. Also noted are the statistically significant instructional practices of mathematics review on the computer, mathematics enrichment on the computer, mathematics research on the computer, setting different achievement standards for some students, and supplementing the regular curriculum.

Research Question #2

How are teachers' professional development experiences related to the student achievement on the NeSA-Mathematics Test? Frequencies of responses and descriptive statistics for Professional Development in the area of Topics can be found in Tables 9 and 10. Frequencies of responses and descriptive statistics for Professional Development in the area of Format can be found in Tables 11 and 12.

Table 13 shows that there are differences in the intercepts (Professional Development – Topics). There are no statistically significant differences between teachers' classrooms when comparing Professional Development – Topics they reported participating in.

Table 14 shows that there are differences in the intercepts (Professional Development – Formats). Also noted are the statistically significant professional development formats including committee or task force focusing on curriculum, instruction, or student assessment, regularly scheduled discussion group or study group, and consultation with a subject specialist.

Table 1

Means of Teachers' Classroom Student Achievement on the 2014 NeSA-Mathematics

Teacher ID	Mean	*N*	*SD*
31	131.43	21	37.449
32	126.71	21	28.686
33	154.38	21	23.705
34	112.60	20	25.714
35	131.95	22	23.770
36	127.25	24	22.187
37	123.52	23	26.216
41	122.63	16	23.082
42	109.89	18	24.862
43	105.79	19	32.305
44	145.15	20	39.016
45	128.29	17	34.133
46	109.94	17	26.037
47	116.53	17	22.913
48	114.21	19	36.549
49	127.62	21	37.372
51	110.90	21	34.126
52	134.33	24	36.168
53	129.24	21	44.059
54	137.63	24	26.753
55	137.20	10	33.482
56	133.14	21	35.854
61	103.84	19	34.108
62	132.50	20	27.961
63	117.81	26	37.198
64	142.67	12	34.909
65	125.28	25	33.628
66	133.32	19	29.328
67	126.84	19	32.279
Total	125.92	577	33.114

Table 2

Frequencies of Responses for Instructional Practices – Technology

Indicator	Never or hardly ever	Once or twice a month	Once or twice a week	Every day or almost every day
Practice or review mathematics topics on the computer	1	6	9	13
Extend mathematics learning with enrichment activities on the computer	1	10	11	7
Research a mathematics topic using a computer	14	14	1	0
Use a drawing computer application for geometry	24	4	1	0
Play mathematics computer games	2	6	17	4

Table 3

Descriptive Statistics for Responses for Instructional Practices – Technology

Indicator	*N*	Min	Max	Mean	*SD*
Practice or review mathematics topics on the computer	29	0	3	2.17	.889
Extend mathematics learning with enrichment activities on the computer	29	0	3	1.83	.848
Research a mathematics topic using a computer	29	0	2	.55	.572
Use a drawing computer application for geometry	29	0	2	.24	.511
Play mathematics computer games	29	0	3	1.79	.774

Table 4

Frequencies of Responses for Instructional Practices – Differentiation

Indicator	Not At All	Small Extent	Moderate Extent	Large Extent
Set different achievement standards for some students	1	12	12	4
Supplement the regular course curriculum with additional material for some students	0	9	15	5
Use a different set of methods in teaching some students	0	7	17	5
Pace my teaching differently for some students	0	6	17	6

Table 5

Descriptive Statistics for Responses for Instructional Practices – Differentiation

Indicator	*N*	Min	Max	Mean	*SD*
Set different achievement standards for some students	29	0	3	1.66	.769
Supplement the regular course curriculum with additional material for some students	29	1	3	1.86	.693
Use a different set of methods in teaching some students	29	1	3	1.93	.651
Pace my teaching differently for some students	29	1	3	2.00	.655

Table 6

Frequencies of Responses for Instructional Practices – Goal Setting

Indicator	Never or hardly ever	A Few Time A Year	Once or twice a month	Once or twice a week	Every day or almost every day
Discuss the student's current level of performance	0	9	11	4	5
Set goals for specific progress the student would like to make	6	5	7	7	4

Table 7

Descriptive Statistics for Responses for Instructional Practices – Goal Setting

Indicator	*N*	Min	Max	Mean	*SD*
Discuss the student's current level of performance	29	1	4	2.17	1.071
Set goals for specific progress the student would like to make	29	0	4	1.93	1.361

Table 8

Estimates of Fixed Effects for Instructional Practices

Effect	Estimate	Standard Error	DF	*t* Value	Sig.
Intercept	150.20	7.9873	18	18.81	<.0001
Practice or review mathematics topics on the computer	-8.3667	2.4193	547	-3.46	0.0006
Extend mathematics learning with enrichment activities on the computer	7.3725	2.8029	547	2.63	0.0088
Research a mathematics topic using a computer	-7.5077	3.4912	547	-2.15	0.0320
Use a drawing computer application for geometry	-1.3123	3.7681	547	-0.35	0.7278
Play mathematics computer games	-2.7740	2.2413	547	-1.24	0.2164
Set different achievement standards for some students	7.5682	3.1216	547	2.42	0.0157
Supplement the regular course curriculum with additional material for some students	-11.0162	3.5966	547	-3.06	0.0023
Use a different set of methods in teaching some students	-5.5529	4.1199	547	-1.35	0.1783
Pace my teaching differently for some students	7.6273	4.2177	547	1.81	0.0711
Discuss the student’s current level of performance	-2.5656	2.6304	547	-0.98	0.3298
Set goals for specific progress the student would like to make	-0.6674	2.0984	547	-0.32	0.7505

Table 9

Frequencies of Responses for Professional Development - Topics

Indicator	Not At All	Small Extent	Moderate Extent	Large Extent
How students learn mathematics	0	7	19	3
Mathematics theory or applications	1	8	17	3
Content standards in mathematics	0	6	11	12
Curricular materials available in mathematics	0	6	20	3
Instructional methods for teaching mathematics	0	7	16	6
Effective use of manipulatives in mathematics instruction	0	7	15	7
Effective use of calculators in mathematics instruction	12	10	3	4
Use of computers or other technology in mathematics instruction	1	11	16	1
Methods for assessing students in mathematics	0	7	22	0
Preparation of students for district and state assessments	0	12	14	3
Issues related to ability grouping in mathematics	2	12	13	1

Table 10

Descriptive Statistics for Responses for Professional Development - Topics

Indicator	*N*	Min	Max	Mean	*SD*
How students learn mathematics	29	1	3	1.86	.581
Mathematics theory or applications	29	0	3	1.76	.689
Content standards in mathematics	29	1	3	2.21	.774
Curricular materials available in mathematics	29	1	3	1.90	.557
Instructional methods for teaching mathematics	29	1	3	2.03	.680
Effective use of manipulatives in mathematics instruction	29	1	3	2.00	.707
Effective use of calculators in mathematics instruction	29	0	3	.97	1.052
Use of computers or other technology in mathematics instruction	29	0	3	1.57	.628
Methods for assessing students in mathematics	29	1	2	1.76	.435
Preparation of students for district and state assessments	29	1	3	1.69	.660
Issues related to ability grouping in mathematics	29	0	3	1.46	.693

Table 11

Frequencies of Responses for Professional Development - Formats

Indicator	No	Yes
College course taken since your certification	22	7
Workshop or training session	3	26
Conference or professional association meeting	11	18
Observational visit to another school or classroom	18	11
Mentoring or peer observation and coaching as part of a formal arrangement	19	10
Committee or task force focusing on curriculum, instruction, or student assessment	15	14
Regularly scheduled discussion group or study group	18	11
Teacher collaborative or network, such as one organized by an outside agency or over the Internet	16	13
Individual or collaborative research	11	17
Independent reading on a regular basis – for example, educational journals, books, or the Internet	10	19
Co-teaching/team teaching	15	14
Consultation with a subject specialist	7	22
Collaborative Math Project	4	25

Table 12

Descriptive Statistics for Responses for Professional Development - Formats

Indicator	*N*	Min	Max	Mean	*SD*
College course taken since your certification	29	0	1	.24	.435
Workshop or training session	29	0	1	.90	.310
Conference or professional association meeting	29	0	1	.62	.494
Observational visit to another school or classroom	29	0	1	.38	.494
Mentoring or peer observation and coaching as part of a formal arrangement	29	0	1	.34	.484
Committee or task force focusing on curriculum, instruction, or student assessment	29	0	1	.48	.509
Regularly scheduled discussion group or study group	29	0	1	.38	.494
Teacher collaborative or network, such as one organized by an outside agency or over the Internet	29	0	1	.45	.506
Individual or collaborative research	29	0	1	.62	.494
Independent reading on a regular basis – for example, educational journals, books, or the Internet	29	0	1	.66	.484
Co-teaching/team teaching	29	0	1	.48	.509
Consultation with a subject specialist	29	0	1	.28	.455
Collaborative Math Project	29	0	1	.86	.351

Table 13

Estimates of Fixed Effects for Professional Development - Topics

Effect	Estimate	Standard Error	DF	*t* Value	Sig.
Intercept	108.11	11.0678	16	9.77	<.0001
How students learn mathematics	1.8506	5.8110	524	0.32	0.7503
Mathematics theory or applications	7.4860	5.4073	524	1.38	0.1668
Content standards in mathematics	4.3821	3.0125	524	1.45	0.1464
Curricular materials available in mathematics	-7.4486	5.4955	524	-1.36	0.1759
Instructional methods for teaching mathematics	-7.1402	4.9250	524	-1.45	0.1477
Effective use of manipulatives in mathematics instruction	9.3090	4.9900	524	1.87	0.0627
Effective use of calculators in mathematics instruction	-2.2868	3.0515	524	-0.75	0.4540
Use of computers or other technology in mathematics instruction	-0.8683	3.9423	524	-0.22	0.8258
Methods for assessing students in mathematics	8.4427	5.0563	524	1.67	0.0956
Preparation of students for district and state assessments	0.0938	3.8488	524	0.02	0.9806
Issues related to ability grouping in mathematics	-6.6775	3.8979	524	-1.71	0.0873

Table 14

Estimates of Fixed Effects for Professional Development - Formats

Effect	Estimate	Standard Error	DF	*t* Value	Sig.
Intercept	127.28	10.5189	15	12.10	<.0001
College course taken since your certification	-1.3922	4.7188	548	-0.30	0.7681
Workshop or training session	5.8583	7.3115	548	0.80	0.4233
Conference or professional association meeting	4.2208	5.9774	548	0.71	0.4804
Observational visit to another school or classroom	-1.3556	4.8956	548	-0.28	0.7820
Mentoring or peer observation and coaching as part of a formal arrangement	6.9848	4.4665	548	1.56	0.1184
Committee or task force focusing on curriculum, instruction, or student assessment	-9.2959	4.6493	548	-2.00	0.0461
Regularly scheduled discussion group or study group	-10.9873	5.0864	548	-2.16	0.0312
Teacher collaborative or network, such as one organized by an outside agency or over the Internet	-6.1452	4.4758	548	-1.37	0.1703
Individual or collaborative research	6.7098	4.3664	548	1.54	0.1249
Independent reading on a regular basis – for example, educational journals, books, or the Internet	-1.2464	4.9237	548	-0.25	0.8003
Co-teaching/team teaching	6.0283	3.9125	548	1.54	0.1239
Consultation with a subject specialist	11.7514	4.3269	548	2.72	0.0068
Collaborative Math Project	-10.6174	6.1305	548	-1.73	0.0839

Chapter 5

Conclusions and Discussion

Purpose of the Study

The purpose of this study was to analyze how teacher instructional practices and teacher involvement in professional development are related to student achievement on the Nebraska State Accountability Mathematics Test (NeSA-M). This study examined the variable of student achievement related to the variables of teacher practices in instruction and professional development.

Students in grades three through six were included and sorted by mathematics teachers. The data was available for twenty-nine teachers and NeSA-M scale scores were available and matched to teachers for 577 students. All student and teacher data was masked in study documents to protect the identity of individual students and teachers. All teachers within the study were asked to complete a survey about professional development and classroom instructional practices. Teacher surveys are used by the district to gather information annually each spring. Teacher surveys were coded to link them to their students' test scores. Responses were categorized as to the impact on student achievement and an analysis of instructional practices was completed and matched to achievement.

By recognizing the connection between teachers and student achievement this study attempted to respond to the broad question: what is the relationship between teachers' practices and student achievement?

Conclusions

The following conclusions were drawn from the study of the two research questions.

Research Question #1

Research question #1 was used to analyze whether teachers' instructional practices were related to student achievement on the 2014 NeSA-Mathematics Test. Five instructional practices identified on the Teacher Questionnaire were statistically significant when examining student achievement. The hypothesis was that teachers' instructional practices would positively impact students' achievement if they were using sound instructional practices.

The results showed only two indicators had a positive impact on student achievement. The first indicator was expanding mathematics practice for enrichment on a computer which had an average positive influence of more than seven points on student achievement on the NeSA-M test. The other indicator was setting different goals for individual students and this indicator showed a positive influence on student achievement of over seven and one-half points.

Three other instructional practices showed a negative impact of NeSA-M test scores. These practices were using a computer for math practice (-8.4 points), using a computer for math research (-7.5 points), and using materials to supplement math instruction (-11.0 points).

It was also interesting to note, while not statistically significant, that teachers who reported pacing their teaching differently for some students impacted NeSA-Mathematics scores positively more than seven and one-half points.

Research Question #2

Research question #2 was used to analyze whether teachers' participation in professional development activities was related to the student achievement on the 2014 NeSA-Mathematics Test. The professional development activities were reported by teachers by the topics covered and by the format through which the learning opportunity occurred. The hypothesis was that teachers' participation in professional development would positively impact students' achievement. The research had potential to identify whether there were topics or formats of greater value for improving student achievement.

None of the professional development topics showed a statistically significant impact on student achievement on the NeSA-M test. Three of the indicators in professional development formats were statistically significant but only one of these had a positive relationship with student achievement. Teachers who reported consulting with a subject specialist had class averages nearly twelve points above the average of all classrooms. The two indicators showing a negative relationship were teachers participating with a regularly scheduled study or discussion group (-11.0 points) and teachers serving on a committee to study curriculum, instruction, or assessment (-9.3 points).

Discussion

By definition, teaching is effective when it enables student learning (Bill & Melinda Gates Foundation, 2013). It is clear that effective teachers have a profound influence on student achievement and ineffective teachers do not (Bill & Melinda Gates Foundation, 2013; DeWitt, 2011; Kane, Taylor, Tyler, & Wooten, 2010; Marzano, Pickering, & Pollock, 2001). Wenglisky's (2001) quantitative study on classroom practices and student achievement confirmed the effect of teachers' instruction on student performance. This study also supports the impact of teachers' instructional practices on student achievement. The concern raised using these results is that the impact may not always be positive. The indicator with the greatest impact on student achievement was supplementing the regular curriculum with additional materials. This significant indicator showed classroom achievement averaging more than eleven points less than the average of all groups of students in this study. This result may support the work of other researchers who espouse the importance of a guaranteed viable curriculum taught with fidelity. The core curriculum must be carefully aligned to measureable standards and the achievement measurement tool students will be asked to demonstrate performance. Teachers must be held accountable to implement curriculum with fidelity. These results may cause building administrators to more closely supervise teachers to insure instructional practices do not decrease the effectiveness of the adopted curriculum.

Improving the quality of instruction students receive is one of the most important things districts can do to improve student achievement (Hasiotis, Grogan, Lawrence, Maier & Wilpon, 2015). A recently released study from The New Teacher Project (TNTP) reports that school districts are extraordinarily committed to supporting teachers' professional growth as the primary strategy for accelerating student learning. This confirms other work done concerning the professional development of teachers, but raises grave concerns about the investment in professional development translating into true improvement. The research presented here also voices concern about the limited relationship found between professional development and student achievement. No significant results were found between the topics in which teachers received development in and student achievement results. When the format of the professional development teachers attended was analyzed, there were some significant results. A similar study of student achievement on state tests and teacher professional development completed in New York City found similar results (Alvarez, 2008). The New York study found a single format of professional development, collaboration, having any significant relationship with student achievement.

Professional development activities need to be carefully aligned to the goals of a school district and evaluated for effectiveness in the improvement of teaching and ultimately student achievement. Administrators need to identify observable, measurable professional development focused on high quality teaching and student learning, then insure the implementation of new skills. One format of professional development showed a significant relationship to student achievement in this study: teachers who reported working with a subject specialist had student achievement scores nearly twelve points higher than the average of all teachers' students. These results may support proposals to add subject specialists to the research district.

This study demonstrates that there is a link between instructional practices and professional development. These results, however, suggest issues that should be analyzed in greater depth. Further investigations could validate teacher survey responses with classroom observations to determine fidelity of the implementation of instructional practices or newly learned skills through professional development. It would, also, be interesting to examine similar variables applied to other educational settings such as middle school and/or high schools, even in more specialized context such as special education. Finally, since the literature reviewed for this study included the teacher evaluation process, it would be of interest to expand this study to consider this variable.

There does not seem to be a doubt that the teacher in the classroom has the greatest influence on student learning and achievement, but effectiveness can be difficult to measure. Effective teaching must be carefully defined as observable practices and followed with accountability to implement these practices. Teachers must commit to continuous improvement with the target of student achievement clearly the focus, because as Marva Collins (1992) reminds educators "when our students fail, we, as teachers, too, have failed."

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Appendix A

Teacher Questionnaire Elementary Math

Bennington's students continue to perform well on the NeSA assessments. Strategic planning and school improvement goals are focused on improving teaching and learning in the district.

This questionnaire collects information about a teacher's instructional practices in mathematics as well as professional development. This data will be used for research purposes to investigate the relationship between student achievement and various teacher factors. Your responses may also be used to guide future planning for the school district.

Please complete the entire questionnaire. Results will be shared with interested teachers and district administrators at the conclusion of this research.

* 1. What is your first name?

* 2. What is your last name?

3. Excluding student teaching, how many years have you worked as an elementary teacher, counting this year?

- Less than 1 year
- 1 – 2 years
- 3 – 5 years
- 6 – 10 years
- 11 – 20 years
- 21 or more years

4. Consider all of the professional development activities you participated in during the last two years. To what extent did you learn about each of the following topics? Fill in one response on each line.

	Not at all	Small Extent	Moderate Extent	Large Extent
How students learn mathematics	○	○	○	○
Mathematics theory or applications	○	○	○	○
Content standards in mathematics	○	○	○	○
Curricular materials available in mathematics	○	○	○	○
Instructional methods for teaching mathematics	○	○	○	○
Effective use of manipulatives in mathematics instruction	○	○	○	○
Effective use of calculators in mathematics instruction	○	○	○	○
Use of computers or other technology in mathematics instruction	○	○	○	○
Methods for assessing students in mathematics	○	○	○	○
Preparation of students for district and state assessments	○	○	○	○
Issues related to ability grouping in mathematics	○	○	○	○
Strategies for teaching mathematics to students from diverse backgrounds (including English Language Learners)	○	○	○	○

5. During the last two years, did you participate in any of the following professional development activities related to the teaching of mathematics? Fill in one response per line.

	Yes	No
College course taken since your certification	◯	◯
Workshop or training session	◯	◯
Conference or professional association meeting	◯	◯
Observational visit to another school or classroom	◯	◯
Mentoring or peer observation and coaching as part of a formal arrangement	◯	◯
Committee or task force focusing on curriculum, instruction, or student assessment	◯	◯
Regularly scheduled discussion group or study group	◯	◯
Teacher collaborative or network, such as one organized by an outside agency or over the Internet	◯	◯
Individual or collaborative research	◯	◯
Independent reading on a regular basis – for example, educational journals, books, or the Internet	◯	◯
Co-teaching/team teaching	◯	◯
Consultation with a subject specialist	◯	◯
Participation in Collaborative Math Project	◯	◯

The following questions ask about the organization of your classroom for mathematics instruction. If you teach more than one class, please choose a single class to use as the basis for answering the questions about classroom organization. If you are not teaching math this year, please answer based on the last group of students you taught for mathematics in Bennington Public Schools.

6. How many hours of mathematics instruction do your students receive in a typical week?

- Less than 3 hours
- At least 3 hours, but less than 5 hours
- At least 5 hours, but less than 7 hours
- 7 or more hours

7. Are students assigned to this class by ability?

- Yes
- No

8. Do you create groups within this class for mathematics instruction on the basis of ability?

- Yes
- No

9. How often do you use each of the following to assess student progress in mathematics? Fill in one response per line.

	Never or hardly ever	Once or twice a year	Once or twice a month	Once or twice a week
Multiple-choice tests	◯	◯	◯	◯
Problem sets	◯	◯	◯	◯
Short (e.g. a phrase or sentence) or long (e.g. several sentences or paragraphs) written responses	◯	◯	◯	◯
Individual or group projects or presentations	◯	◯	◯	◯

10. Approximately how much mathematics homework do you assign to students in this class each day?

- None
- 15 minutes
- 30 minutes
- 45 minutes
- One hour
- More than one hour

11. Think about your plans for this mathematics class for the entire year. How much emphasis did you or will you give each of the following? Fill in one response per line.

	Little or no emphasis	Moderate emphasis	Heavy emphasis
Numbers and operations	○	○	○
Measurement	○	○	○
Geometry	○	○	○
Data analysis, statistics, and probability	○	○	○
Algebra and functions	○	○	○

12. In your mathematics class this year, how often do your students use a computer or other technological resources to do each of the following? Fill in one response per line.

	Never or hardly ever	Once or twice a month	Once or twice a week	Every day or almost every day
Practice or review mathematics topics on the computer	○	○	○	○
Extend mathematics learning with enrichment activities on the computer	○	○	○	○
Research a mathematics topic using a computer	○	○	○	○
Use a drawing computer application for geometry	○	○	○	○
Play mathematics computer games	○	○	○	○

13. When you teach mathematics to your class, do you do any of the following? Fill in one response per line.

	Not at all	Small extent	Moderate extent	Large extent
Set different achievement standards for some students	◯	◯	◯	◯
Supplement the regular course curriculum with additional material for some students	◯	◯	◯	◯
Have some students engage in different classroom activities	◯	◯	◯	◯
Use a different set of methods in teaching some students	◯	◯	◯	◯
Pace my teaching differently for some students	◯	◯	◯	◯

14. How often do you do each of the following with individual students to evaluate their progress in mathematics? Fill in one response per line.

	Never or hardly ever	A few times a year	Once or twice a month	Once or twice a week	Every day or almost every day
Discuss the student's current level of performance	◯	◯	◯	◯	◯
Set goals for specific progress the student would like to make	◯	◯	◯	◯	◯
Discuss progress the student has made toward the goals previously set	◯	◯	◯	◯	◯
Determine how to adjust your teaching strategies to meet the student's current learning needs and to reflect the student's future goals	◯	◯	◯	◯	◯